

INFORMATION HANDOUT

For Contract No. 04-1SS224

At 04-Son-128-2.4, 2.6

Identified by

Project ID 0400020888

PERMITS

California Department of Fish and Wildlife dated June 5, 2014

MATERIALS INFORMATION

Slipout Repair Recommendations – Soldier Pile Wall dated October 19, 2012

Landslide Repair Recommendations dated November 6, 2012

ET-31 Guardrail End Treatment Product Description Assembly Manual created January 2013

Sequential Kinking Terminal SKT – Assembly dated 12/01/04

X-Tension Guardrail Terminal System Steel Post with Composite Blockout 31" Rail Height Rev B dated 05/02/13



State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Bay Delta Region
7329 Silverado Trail
Napa, CA 94558
(707) 944-5500
www.wildlife.ca.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director



June 5, 2014

Mr. Javier Almaguer
California Department of Transportation
855 M Street, Suite 200
Fresno, CA 93721

Subject: Final Lake or Streambed Alteration Agreement
Notification No. 1600-2014-0018-R3
Oat Valley Slide Repair Project

Dear Mr. Almaguer:

Enclosed is the final Streambed Alteration Agreement (“Agreement”) for the Oat Valley Slide Repair Project (“Project”). Before the Department may issue an Agreement, it must comply with the California Environmental Quality Act (“CEQA”). In this case, the Department, acting as a responsible agency, filed a notice of determination (“NOD”) on June 5, 2014 based on information contained in the Negative Declaration the lead agency prepared for the Project.

Under CEQA, filing a NOD starts a 30-day period within which a party may challenge the filing agency’s approval of the project. You may begin your project before the 30-day period expires if you have obtained all necessary local, state, and federal permits or other authorizations. However, if you elect to do so, it will be at your own risk.

If you have any questions regarding this matter, please contact Melissa Escaron, Senior Environmental Scientist (Specialist), at (925)786-3045 or melissa.escaron@wildlife.ca.gov.

Sincerely,

Craig J. Weightman
Environmental Program Manager
Bay Delta Region

cc: Sarah Soliman – sarah.soliman@dot.ca.gov
Lieutenant Jones
Warden Reed

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE
BAY DELTA REGION
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STREAMBED ALTERATION AGREEMENT
NOTIFICATION No. 1600-2014-0018-R3
Oat Valley Creek Slide Project

CALIFORNIA DEPARTMENT OF TRANSPORTATION

This Streambed Alteration Agreement (Agreement) is entered into between the California Department of Fish and Wildlife (CDFW) and the California Department of Transportation (Permittee), as represented by Mr. Javier Almaguer.

RECITALS

WHEREAS, pursuant to Fish and Game Code (FGC) section 1602, Permittee notified CDFW on January 21, 2014 that Permittee intends to complete the project described herein.

WHEREAS, pursuant to FGC section 1603, CDFW has determined that the project could substantially adversely affect existing fish or wildlife resources and has included measures in the Agreement necessary to protect those resources.

WHEREAS, Permittee has reviewed the Agreement and accepts its terms and conditions, including the measures to protect fish and wildlife resources.

NOW THEREFORE, Permittee agrees to complete the project in accordance with the Agreement

PROJECT LOCATION

This Project is located in Sonoma County on State Route 128, at Post Mile 2.36, near the City of Cloverdale.

PROJECT DESCRIPTION

The Project will repair a landslide located on westbound State Route 128 at Post Mile 2.36. A soldier pile retaining wall approximately 10 feet high by 90 feet long will be constructed to stabilize the slide and prevent further roadway movement. The westbound roadway will also be widened to the standard 12 foot lane and 4 foot shoulder. All access will be from the closed westbound roadway.

MEASURES TO PROTECT FISH AND WILDLIFE RESOURCES

1. Administrative Measures

Permittee shall meet each administrative requirement described below.

- 1.1 Documentation at Project Site. Permittee shall make the Agreement, any extensions and amendments to the Agreement, and all related notification materials and California Environmental Quality Act (CEQA) documents, readily available at the project site at all times and shall be presented to CDFW personnel, or personnel from another state, federal, or local agency upon request.
- 1.2 Providing Agreement to Persons at Project Site. Permittee shall provide copies of the Agreement and any extensions and amendments to the Agreement to all persons who will be working on the project at the project site on behalf of Permittee, including but not limited to contractors, subcontractors, inspectors, and monitors.
- 1.3 Notification of Conflicting Provisions. Permittee shall notify CDFW if Permittee determines or learns that a provision in the Agreement might conflict with a provision imposed on the project by another local, state, or federal agency. In that event, CDFW shall contact Permittee to resolve any conflict.
- 1.4 Project Site Entry. Permittee agrees that CDFW personnel may enter the project site, at any time to verify compliance with the Agreement.

2. Avoidance and Minimization Measures

To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee shall implement each measure listed below. These conditions only apply to activities within the CDFW 1602 jurisdiction.

- 2.1 All work within riparian zones shall occur between June 15 and October 15.
- 2.2 At least 30-days prior to commencing Project activities covered by this Agreement, the Permittee shall submit to CDFW, for review and approval, the

qualifications for a number of biologists (Qualified Biologist) that shall oversee the implementation of the conditions in this Agreement. At a minimum, the Qualified Biologists shall have a combination of academic training and professional experience in biological sciences and related resource management activities. The Qualified Biologists shall communicate to the Resident Engineer when any activity is not in compliance with this Agreement and the Resident Engineer shall immediately stop the activity that is not in compliance with this Agreement.

- 2.3 Before the onset of construction activities, a Qualified Biologist shall conduct an education program for all construction personnel. At a minimum the training will include a description of California red legged frog, and migratory birds, and their habitats; the occurrence of these species within the Project site; an explanation of their state and federal statuses; avoidance and minimization measures; habitats as they relate to the Project site; and boundaries within which construction may occur. A fact sheet conveying this information will be prepared and distributed to all construction crews and Project personnel entering the Project site. Upon completion of the program, personnel will sign a form stating that they attended the program and understand all the avoidance and minimization measures.
- 2.4 If Project activities will occur between February 15 and September 1, a Qualified Biologist shall conduct pre-construction surveys for nesting birds no more than one week prior to construction. Surveys shall consist of multiple days of observations. If nests are found the Qualified Biologist shall establish an appropriate buffer to be in compliance with Migratory Bird Treaty Act (MBTA) and Fish and Game Code 3503. The Qualified Biologist shall perform at least two hours of pre-construction monitoring of the nest to characterize "typical" bird behavior. The Qualified Biologist shall monitor the nesting birds and shall increase the buffer if the Qualified Biologist determines the birds are showing signs of unusual or distressed behavior by Project activities. Atypical nesting behaviors which may cause reproductive harm include, but are not limited to, defensive flights/vocalizations directed towards Project personnel, standing up from a brooding position, and flying away from the nest. The Qualified Biologist shall have authority, through the Resident Engineer, to order the cessation of all Project activities if the nesting birds exhibit atypical behavior which may cause reproductive failure (nest abandonment and loss of eggs and/or young) until an appropriate buffer is established. To prevent encroachment, the established buffer(s) shall be clearly marked by high visibility material. The established buffer(s) shall remain in effect until the young have fledged or the nest has been abandoned as confirmed by the Qualified Biologist. Any sign of nest abandonment shall be reported to CDFW within 48 hours.
- 2.5 Permittee shall conduct work defined in the above Project Description, and within the Project area, during periods of dry weather. The Project area is defined as the bed, bank, channel, and associated wetland habitat. The

Permittee shall monitor forecasted precipitation. When $\frac{1}{4}$ inch or more of precipitation is forecasted to occur, the Permittee shall stop work before precipitation commences. No Project activities may be started if its associated erosion control measures cannot be completed prior to the onset of precipitation. After any storm event, the Permittee shall inspect all sites currently under construction and all sites scheduled to begin construction within the next 72 hours for erosion and sediment problems and take corrective action as needed. Seventy-two hour weather forecasts from National Weather Service shall be consulted and work shall not start back up until runoff ceases and there is less than a 30% forecast for precipitation for the following 24-hour period.

- 2.6 Permittee shall utilize erosion control measures throughout all phases of operation where sediment runoff from exposed slopes threatens to enter waterways. At no time shall silt laden runoff be allowed to enter the stream or directed to where it may enter the stream. Erosion control installations shall be monitored for effectiveness and shall be repaired or replaced as recommended by a Qualified Biologist or Water Quality Monitor to the Resident Engineer. As needed to prevent sediment transport, Permittee shall deploy soil stabilizer such as hydroseeding, netting, erosion control mats, mulch, fiber rolls, silt fences, check dams, and flow velocity dissipation devices. Permittee shall stabilize and equip construction site entrances and exits with tire washing capability. Materials containing monofilament or plastic shall not be used. Erosion and sediment control measures shall be installed prior to unseasonable rain storms.
- 2.7 All disturbed areas shall be re-graded and hydroseeded. Hydroseed shall not contain invasive exotic plant species. Prohibited exotic plant species include those identified in the California Exotic Pest Plant Council's database, which is accessible at: <http://www.calipc.org/ip/inventory/weedlist.php>.
- 2.8 Staging and storage areas for equipment, materials, fuels, lubricants and solvents, shall be located outside of the creek channel and banks. Stationary equipment such as motors, pumps, generators, compressors and welders, located within or adjacent to the creek shall be positioned over drip pans. Any equipment or vehicles driven and/or operated within or adjacent to the stream must be checked and maintained daily, to prevent leaks of materials that if introduced to water could be deleterious to aquatic life.
- 2.9 Refueling of mobile construction equipment and vehicles shall not occur within 50 feet of any water body, or anywhere that spilled fuel could drain to a water body. Refueling of stationary equipment requiring breakdown and setup to move will remain in place. All equipment shall be refueled with appropriate drip pans, absorbent pads, and water quality Best Management Practices. Equipment and vehicles operating in the Project site shall be checked and maintained daily to prevent leaks of fuels, lubricants, or other liquids.

2.10 Permittee shall comply with all applicable state and federal laws, including the California and Federal Endangered Species Act. This Agreement does not authorize the take of any state or federally endangered listed species. Liability for any take or incidental take of such species remains the responsibility of the Permittee for the duration of the Project. Any unauthorized take of listed species may result in prosecution and nullification of the Agreement. This Agreement does not authorize the capture or relocation of Fully Protected Species.

3. Project Impacts

Project impacts will be less than significant with the implementation of the above listed avoidance measures. No mitigation is required.

CONTACT INFORMATION

Any communication that Permittee or CDFW submits to the other shall be in writing and any communication or documentation shall be delivered to the address below by U.S. mail, fax, or email, or to such other address as Permittee or CDFW specifies by written notice to the other.

To Permittee:

California Department of Transportation
Mr. Javier Almaguer
855 M St. Suite 200
Fresno, Ca 93721

To CDFW:

California Department of Fish and Wildlife
Bay Delta Region
7329 Silverado Trail
Napa, California 94558
Attn: Lake and Streambed Alteration Program – Melissa Escaron
Notification #1600-2014-0018-R3
Fax (707) 944-5553
Melissa.escaron@wildlife.ca.gov

LIABILITY

Permittee shall be solely liable for any violations of the Agreement, whether committed by Permittee or any person acting on behalf of Permittee, including its officers,

employees, representatives, agents or contractors and subcontractors, to complete the project or any activity related to it that the Agreement authorizes.

This Agreement does not constitute CDFW's endorsement of, or require Permittee to proceed with the project. The decision to proceed with the project is Permittee's alone.

SUSPENSION AND REVOCATION

CDFW may suspend or revoke in its entirety the Agreement if it determines that Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, is not in compliance with the Agreement.

Before CDFW suspends or revokes the Agreement, it shall provide Permittee written notice by certified or registered mail that it intends to suspend or revoke. The notice shall state the reason(s) for the proposed suspension or revocation, provide Permittee an opportunity to correct any deficiency before CDFW suspends or revokes the Agreement, and include instructions to Permittee, if necessary, including but not limited to a directive to immediately cease the specific activity or activities that caused CDFW to issue the notice.

ENFORCEMENT

Nothing in the Agreement precludes CDFW from pursuing an enforcement action against Permittee instead of, or in addition to, suspending or revoking the Agreement.

Nothing in the Agreement limits or otherwise affects CDFW's enforcement authority or that of its enforcement personnel.

OTHER LEGAL OBLIGATIONS

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from obtaining any other permits or authorizations that might be required under other federal, state, or local laws or regulations before beginning the project or an activity related to it.

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from complying with other applicable statutes in the FGC including, but not limited to, FGC sections 2050 et seq. (threatened and endangered species), 3503 (bird nests and eggs), 3503.5 (birds of prey), 5650 (water pollution), 5652 (refuse disposal into water), 5901 (fish passage), 5937 (sufficient water for fish), and 5948 (obstruction of stream).

Nothing in the Agreement authorizes Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, to trespass.

AMENDMENT

CDFW may amend the Agreement at any time during its term if CDFW determines the amendment is necessary to protect an existing fish or wildlife resource.

Permittee may amend the Agreement at any time during its term, provided the amendment is mutually agreed to in writing by CDFW and Permittee. To request an amendment, Permittee shall submit to CDFW a completed CDFW "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the corresponding amendment fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

TRANSFER AND ASSIGNMENT

This Agreement may not be transferred or assigned to another entity, and any purported transfer or assignment of the Agreement to another entity shall not be valid or effective, unless the transfer or assignment is requested by Permittee in writing, as specified below, and thereafter CDFW approves the transfer or assignment in writing.

The transfer or assignment of the Agreement to another entity shall constitute a minor amendment, and therefore to request a transfer or assignment, Permittee shall submit to CDFW a completed CDFW "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the minor amendment fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

EXTENSIONS

In accordance with FGC section 1605(b), Permittee may request one extension of the Agreement, provided the request is made prior to the expiration of the Agreement's term. To request an extension, Permittee shall submit to CDFW a completed CDFW "Request to Extend Lake or Streambed Alteration" form and include with the completed form payment of the extension fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5). CDFW shall process the extension request in accordance with FGC 1605(b) through (e).

If Permittee fails to submit a request to extend the Agreement prior to its expiration, Permittee must submit a new notification and notification fee before beginning or continuing the project the Agreement covers (Fish & G. Code, § 1605, subd. (f)).

EFFECTIVE DATE

The Agreement becomes effective on the date of CDFW's signature, which shall be: 1) after Permittee's signature; 2) after CDFW complies with all applicable requirements under the California Environmental Quality Act (CEQA); and 3) after payment of the applicable FGC section 711.4 filing fee listed at http://www.wildlife.ca.gov/habcon/ceqa/ceqa_changes.html.

TERM

This Agreement shall expire on December 31, 2018 unless it is terminated or extended before then. All provisions in the Agreement shall remain in force throughout its term. Permittee shall remain responsible for implementing any provisions specified herein to protect fish and wildlife resources after the Agreement expires or is terminated, as FGC section 1605(a)(2) requires.

AUTHORITY

If the person signing the Agreement (signatory) is doing so as a representative of Permittee, the signatory hereby acknowledges that he or she is doing so on Permittee's behalf and represents and warrants that he or she has the authority to legally bind Permittee to the provisions herein.

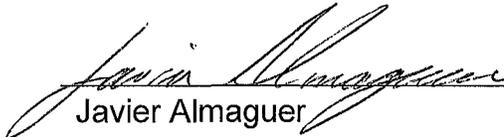
AUTHORIZATION

This Agreement authorizes only the project described herein. If Permittee begins or completes a project different from the project the Agreement authorizes, Permittee may be subject to civil or criminal prosecution for failing to notify CDFW in accordance with FGC section 1602.

CONCURRENCE

The undersigned accepts and agrees to comply with all provisions contained herein.

FOR CALIFORNIA DEPARTMENT OF TRANSPORTATION



Javier Almaguer
Branch Chief

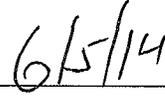
5/19/2014

Date

FOR DEPARTMENT OF FISH AND WILDLIFE



Craig J. Weightman
Environmental Program Manager



Date

Prepared by: Melissa Escaron
Staff Environmental Scientist

Date Sent: April 7, 2014

FOR DEPARTMENT USE ONLY

Date Received	Amount Received	Amount Due	Date Complete	Notification No.
1-21-14	\$ 44,827.50	\$ 429.50		1600-2014-0018-3



V# 082-293491
 Bill Lockyer
 Treasurer

STATE OF CALIFORNIA
 DEPARTMENT OF FISH AND GAME

Escam
 et Jones
 wdr. Reed



NOTIFICATION OF LAKE OR STREAMBED ALTERATION

Complete EACH field, unless otherwise indicated, following the enclosed instructions and submit ALL required enclosures. Attach additional pages, if necessary.

1. APPLICANT PROPOSING PROJECT

Fish & Wildlife

Name	Javier Almaguer		
Business/Agency	California Department of Transportation	JAN 21 2014	
Street Address	855 M Street, Suite 200		
City, State, Zip	Fresno, CA 93721	Napa	
Telephone	(559) 445-6456	Fax	(559) 445-6236
Email	javier.almaguer@dot.ca.gov		

2. CONTACT PERSON (Complete only if different from applicant)

Name	Sarah Soliman		
Street Address	855 M Street, Suite 200		
City, State, Zip	Fresno, CA 93721		
Telephone	(559) 445-6260	Fax	(559) 445-6236
Email	sarah.soliman@dot.ca.gov		

3. PROPERTY OWNER (Complete only if different from applicant)

Name			
Street Address			
City, State, Zip			
Telephone		Fax	
Email			

4. PROJECT NAME AND AGREEMENT TERM

A. Project Name		Oat Valley Creek Slide		
B. Agreement Term Requested		<input checked="" type="checkbox"/> Regular (5 years or less) <input type="checkbox"/> Long-term (greater than 5 years)		
C. Project Term		D. Seasonal Work Period		E. Number of Work Days
Beginning (year)	Ending (year)	Start Date (month/day)	End Date (month/day)	
2015	2019	March 1	October 22	120.00

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

5. AGREEMENT TYPE

Check the applicable box. If box B, C, D, or E is checked, complete the specified attachment.

A.	<input checked="" type="checkbox"/> Standard (Most construction projects, excluding the categories listed below)
B.	<input type="checkbox"/> Gravel/Sand/Rock Extraction (Attachment A) Mine I.D. Number: _____
C.	<input type="checkbox"/> Timber Harvesting (Attachment B) THP Number: _____
D.	<input type="checkbox"/> Water Diversion/Extraction/Impoundment (Attachment C) SWRCB Number: _____
E.	<input type="checkbox"/> Routine Maintenance (Attachment D)
F.	<input type="checkbox"/> DFG Fisheries Restoration Grant Program (FRGP) FRGP Contract Number: _____
G.	<input type="checkbox"/> Master
H.	<input type="checkbox"/> Master Timber Harvesting

6. FEES

Please see the current fee schedule to determine the appropriate notification fee. Itemize each project's estimated cost and corresponding fee. *Note: The Department may not process this notification until the correct fee has been received.*

	A. Project	B. Project Cost	C. Project Fee
1	Oat Valley Creek Slide	\$948,000.00	\$4,912.25
2			
3			
4			
5			
		D. Base Fee (if applicable)	
		E. TOTAL FEE ENCLOSED	\$4,912.25

7. PRIOR NOTIFICATION OR ORDER

A. Has a notification previously been submitted to, or a Lake or Streambed Alteration Agreement previously been issued by, the Department for the project described in this notification?

Yes (Provide the information below) No

Applicant: _____ Notification Number: _____ Date: _____

B. Is this notification being submitted in response to an order, notice, or other directive ("order") by a court or administrative agency (including the Department)?

No Yes (Enclose a copy of the order, notice, or other directive. If the directive is not in writing, identify the person who directed the applicant to submit this notification and the agency he or she represents, and describe the circumstances relating to the order.)

Continued on additional page(s)

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

8. PROJECT LOCATION

A. Address or description of project location. <i>(Include a map that marks the location of the project with a reference to the nearest city or town, and provide driving directions from a major road or highway)</i>					
The project is located on State Route (SR) 128 at post mile (PM) 2.36 near the City of Cloverdale in Sonoma County. Driving Directions from the City of Cloverdale: Head northwest on N. Cloverdale Blvd. toward Broad St. for 1.0 mile. Turn left onto CA-128 W/Oat Valley Rd. for approximately 2.4 miles. Arrive at project location on the right.					
<input type="checkbox"/> Continued on additional page(s)					
B. River, stream, or lake affected by the project.		Oat Valley Creek			
C. What water body is the river, stream, or lake tributary to?		Russian River			
D. Is the river or stream segment affected by the project listed in the state or federal Wild and Scenic Rivers Acts?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown			
E. County	Sonoma				
F. USGS 7.5 Minute Quad Map Name		G. Township	H. Range	I. Section	J. ¼ Section
Cloverdale		12N	11W	35	
<input type="checkbox"/> Continued on additional page(s)					
K. Meridian (check one)		<input type="checkbox"/> Humboldt <input checked="" type="checkbox"/> Mt. Diablo <input type="checkbox"/> San Bernardino			
L. Assessor's Parcel Number(s)					
N/A					
<input type="checkbox"/> Continued on additional page(s)					
M. Coordinates (If available, provide at least latitude/longitude or UTM coordinates and check appropriate boxes)					
Latitude/Longitude	Latitude: 38.838846		Longitude: -123.056638		
	<input type="checkbox"/> Degrees/Minutes/Seconds		<input checked="" type="checkbox"/> Decimal Degrees		<input type="checkbox"/> Decimal Minutes
UTM	Easting:		Northing:		<input type="checkbox"/> Zone 10 <input type="checkbox"/> Zone 11
	Datum used for Latitude/Longitude or UTM		<input type="checkbox"/> NAD 27		<input checked="" type="checkbox"/> NAD 83 or WGS 84

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

9. PROJECT CATEGORY AND WORK TYPE *(Check each box that applies)*

PROJECT CATEGORY	NEW CONSTRUCTION	REPLACE EXISTING STRUCTURE	REPAIR/MAINTAIN EXISTING STRUCTURE
Bank stabilization – bioengineering/recontouring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bank stabilization – rip-rap/retaining wall/gabion	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boat dock/pier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boat ramp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bridge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Channel clearing/vegetation management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Culvert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Debris basin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dam	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diversion structure – weir or pump intake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Filling of wetland, river, stream, or lake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Geotechnical survey	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Habitat enhancement – revegetation/mitigation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Levee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low water crossing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Road/trail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sediment removal – pond, stream, or marina	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Storm drain outfall structure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Temporary stream crossing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Utility crossing : Horizontal Directional Drilling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jack/bore	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Open trench	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other <i>(specify):</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

10. PROJECT DESCRIPTION

A. Describe the project in detail. Photographs of the project location and immediate surrounding area should be included.

- Include any structures (e.g., rip-rap, culverts, or channel clearing) that will be placed, built, or completed in or near the stream, river, or lake.
- Specify the type and volume of materials that will be used.
- If water will be diverted or drafted, specify the purpose or use.

Enclose diagrams, drawings, plans, and/or maps that provide all of the following: site specific construction details; the dimensions of each structure and/or extent of each activity in the bed, channel, bank or floodplain; an overview of the entire project area (i.e., "bird's-eye view") showing the location of each structure and/or activity, significant area features, and where the equipment/machinery will enter and exit the project area.

The project proposes to repair the washout and stop the longitudinal cracks on the westbound section of SR 128 at PM 2.36. A soldier pile retaining wall approximately 10-feet high by 90-feet long would be constructed to stabilize the side slope and prevent further roadway movement. The westbound roadway would be widened to the standard 12-foot lane and 4-foot shoulder. K-rail, a temporary control barrier, would be placed at the existing centerline for the contractor's use to construct the wall and widen the westbound SR 128. One-way traffic control utilizing temporary traffic signals would be implemented during construction. All work will occur within the Caltrans right of way.

The will require 120 working days. The majority of the working days (Approximately 94 working days) will be for the wall work. Listed below are the activities.

The work for location No. 1 will be done behind K-Rail at the top of the road. All equipment and store material if any will be at the top of the slope. The only work down the slope will be the installation of the reinforced silt fencing which will be used to catch any debris from the installation of the CIDH Piling for the retaining wall and tree removal. The reinforced silt fence will be placed at the existing right of way line which is approximately 20 to 30 feet up slope from the existing stream. The silt fencing will be place prior to the piling installation.

See enclosed materials submitted on the compact disc (CD) for all drawings, mappings, project site photos, etc.

Continued on additional page(s)

B. Specify the equipment and machinery that will be used to complete the project.

Please see continuation page.

Continued on additional page(s)

C. Will water be present during the proposed work period (specified in box 4.D) in the stream, river, or lake (specified in box 8.B).

Yes No (Skip to box 11)

D. Will the proposed project require work in the wetted portion of the channel?

Yes (Enclose a plan to divert water around work site)
 No

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

11. PROJECT IMPACTS

A. Describe impacts to the bed, channel, and bank of the river, stream, or lake, and the associated riparian habitat. Specify the dimensions of the modifications in length (linear feet) and area (square feet or acres) and the type and volume of material (cubic yards) that will be moved, displaced, or otherwise disturbed, if applicable.

Permanent impacts include vegetation removal in the area where the soil nail wall will be installed (approximately 1,950 square feet). Temporary impacts (approximately 778 square feet) include debris that may fall as a result of the installation of the wall, however reinforced silt fencing would be installed along the right of way line to prevent any debris from further falling down the slope into the creek. No impacts are anticipated to the bed, channel, and bank of Oat Valley Creek.

Continued on additional page(s)

B. Will the project affect any vegetation? Yes (Complete the tables below) No

Vegetation Type	Temporary Impact	Permanent Impact
Black Oak Woodland	Linear feet: _____ Total area: <u>778 square feet</u>	Linear feet: _____ Total area: <u>1950 square feet</u>
	Linear feet: _____ Total area: _____	Linear feet: _____ Total area: _____

Tree Species	Number of Trees to be Removed	Trunk Diameter (range)
Coast Live Oak	1	5 DBH

Continued on additional page(s)

C. Are any special status animal or plant species, or habitat that could support such species, known to be present on or near the project site?

Yes (List each species and/or describe the habitat below) No Unknown

Continued on additional page(s)

D. Identify the source(s) of information that supports a "yes" or "no" answer above in Box 11.C.

California Natural Diversity Database (CNDDDB), Caltrans Natural Environment Study-Minimal Impact Report

Continued on additional page(s)

E. Has a biological study been completed for the project site?

Yes (Enclose the biological study) No

Note: A biological assessment or study may be required to evaluate potential project impacts on biological resources.

F. Has a hydrological study been completed for the project or project site?

Yes (Enclose the hydrological study) No

Note: A hydrological study or other information on site hydraulics (e.g., flows, channel characteristics, and/or flood recurrence intervals) may be required to evaluate potential project impacts on hydrology.

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

12. MEASURES TO PROTECT FISH, WILDLIFE, AND PLANT RESOURCES

A. Describe the techniques that will be used to prevent sediment from entering watercourses during and after construction.

All construction activities would be completed in accordance with the General Construction Permit and Caltrans Statewide National Pollutant Discharge Elimination System Permit Stormwater Management Plan (SWMP).

To protect drainage areas during construction, the permittee would implement appropriate best management practices (BMPs). These BMPs would be implemented to minimize or eliminate the potential for a non-storm water discharge to occur. Construction site BMPs would be addressed in detail in the Storm Water Pollution Prevention Plan that would be developed for the project site.

Continued on additional page(s) ⁺

B. Describe project avoidance and/or minimization measures to protect fish, wildlife, and plant resources.

Please see the additional pages for discussion of the avoidance and minimization measures.

Continued on additional page(s)

C. Describe any project mitigation and/or compensation measures to protect fish, wildlife, and plant resources.

Replacement planting will occur on-site.

Continued on additional page(s)

13. PERMITS

List any local, state, and federal permits required for the project and check the corresponding box(es). Enclose a copy of each permit that has been issued.

A. _____ N/A _____ Applied Issued

B. _____ Applied Issued

C. _____ Applied Issued

D. Unknown whether local, state, or federal permit is needed for the project. (Check each box that applies)

Continued on additional page(s)

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

14. ENVIRONMENTAL REVIEW

A. Has a draft or final document been prepared for the project pursuant to the California Environmental Quality Act (CEQA), National Environmental Protection Act (NEPA), California Endangered Species Act (CESA) and/or federal Endangered Species Act (ESA)?			
<input checked="" type="checkbox"/> Yes (Check the box for each CEQA, NEPA, CESA, and ESA document that has been prepared and enclose a copy of each)			
<input type="checkbox"/> No (Check the box for each CEQA, NEPA, CESA, and ESA document listed below that will be or is being prepared)			
<input type="checkbox"/> Notice of Exemption	<input type="checkbox"/> Mitigated Negative Declaration	<input checked="" type="checkbox"/> NEPA document (type): <u>CE</u>	
<input checked="" type="checkbox"/> Initial Study	<input type="checkbox"/> Environmental Impact Report	<input type="checkbox"/> CESA document (type): _____	
<input type="checkbox"/> Negative Declaration	<input type="checkbox"/> Notice of Determination (Enclose)	<input type="checkbox"/> ESA document (type): _____	
<input type="checkbox"/> THP/ NTMP	<input type="checkbox"/> Mitigation, Monitoring, Reporting Plan		
B. State Clearinghouse Number (if applicable)		2013022022	
C. Has a CEQA lead agency been determined?		<input checked="" type="checkbox"/> Yes (Complete boxes D, E, and F) <input type="checkbox"/> No (Skip to box 14.G)	
D. CEQA Lead Agency		California Department of Transportation	
E. Contact Person		Scott Smith	F. Telephone Number
			(559) 445-6172
G. If the project described in this notification is part of a larger project or plan, briefly describe that larger project or plan.			
Location 2 of the proposed project occurs on SR 128 at PM 2.6 and proposes to repair the landslide on the eastbound section by installing erosion control mat and wire mesh drapery system as well as five horizontal drains to manage subsurface water.			
<input type="checkbox"/> Continued on additional page(s)			
H. Has an environmental filing fee (Fish and Game Code section 711.4) been paid?			
<input checked="" type="checkbox"/> Yes (Enclose proof of payment)		<input type="checkbox"/> No (Briefly explain below the reason a filing fee has not been paid)	
Note: If a filing fee is required, the Department may not finalize a Lake or Streambed Alteration Agreement until the filing fee is paid.			

15. SITE INSPECTION

Check one box only.	
<input checked="" type="checkbox"/> In the event the Department determines that a site inspection is necessary, I hereby authorize a Department representative to enter the property where the project described in this notification will take place at any reasonable time, and hereby certify that I am authorized to grant the Department such entry.	
<input type="checkbox"/> I request the Department to first contact (insert name) _____ at (insert telephone number) _____ to schedule a date and time to enter the property where the project described in this notification will take place. I understand that this may delay the Department's determination as to whether a Lake or Streambed Alteration Agreement is required and/or the Department's issuance of a draft agreement pursuant to this notification.	

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

16. DIGITAL FORMAT

Is any of the information included as part of the notification available in digital format (i.e., CD, DVD, etc.)?
<input checked="" type="checkbox"/> Yes (Please enclose the information via digital media with the completed notification form)
<input type="checkbox"/> No

17. SIGNATURE

I hereby certify that to the best of my knowledge the information in this notification is true and correct and that I am authorized to sign this notification as, or on behalf of, the applicant. I understand that if any information in this notification is found to be untrue or incorrect, the Department may suspend processing this notification or suspend or revoke any draft or final Lake or Streambed Alteration Agreement issued pursuant to this notification. I understand also that if any information in this notification is found to be untrue or incorrect and the project described in this notification has already begun, I and/or the applicant may be subject to civil or criminal prosecution. I understand that this notification applies only to the project(s) described herein and that I and/or the applicant may be subject to civil or criminal prosecution for undertaking any project not described herein unless the Department has been separately notified of that project in accordance with Fish and Game Code section 1602 or 1611.	
 Signature of Applicant or Applicant's Authorized Representative	01/17/14 Date
Javier Almaguer Print Name	

NOTICE OF DETERMINATION

TO: Office of Planning and Research
Post Office Box 3044
Sacramento, California 95812-3044

FROM: California Department of Fish and Wildlife
Bay Delta Region
7329 Silverado Trail
Napa, California 94558

SUBJECT: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code

PROJECT TITLE: Oat Valley Creek Slide Repair

STATE CLEARINGHOUSE NUMBER: 2013022022

LEAD AGENCY: California Department of Transportation
CONTACT: Javier Almaguer, (559)445-6456

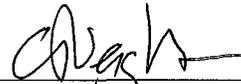
RESPONSIBLE AGENCY: California Department of Fish and Wildlife
CONTACT: Melissa Escaron, (925)786-3045

PROJECT DESCRIPTION / LOCATION: The Project will repair a slide along with a soldier pile retaining wall on State Route 128 at post mile 2.36, near the town of Cloverdale in Sonoma County. The California Department of Fish and Wildlife is executing a Lake and Streambed Alteration Agreement Number 1600-2014-0018-3 pursuant to Section 1602 of the Fish and Game Code to the project Applicant, California Department of Transportation.

This is to advise that the California Department of Fish and Wildlife as a Responsible Agency approved the project described above on June 5, 2014 and has made the following determinations regarding the above described project pursuant to section 15096 (i).

1. The project *will not* have a significant effect on the environment.
2. CDFW considered the Negative Declaration as previously prepared for this project by the Lead Agency.

This is to certify that a copy of the Negative Declaration prepared for this project is available to the general public and may be reviewed at: <http://www.dot.ca.gov/dist4/envdocs.htm>. Please contact the lead agency person specified above.



Craig J. Weightman
Environmental Program Manager
Bay Delta Region

Date Received for Filing: _____

Memorandum

*Flex your power!
Be energy efficient!*

To: MS. OFELIA ALCANTARA
Supervising Bridge Engineer
Bridge Design West
Structures Design

Date: October 19, 2012

Attention: G. Danke

File: 4-SON-128- PM 2.36
04 – 1SS220
Efis: 0400020888-0
Storm Damage
Soldier Pile Wall

Ak
From: A. KADDOURA/M. ZABOLZADEH
Associate M and R Engineers
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

H. Nikouei
HOOSHMAND NIKOUI
Chief, Branch A
Office of Geotechnical Design - West
Geotechnical Services
Division of Engineering Services

Subject: Slipout Repair Recommendations - Soldier Pile Wall

1. INTRODUCTION

As per your request dated May 7, 2012, we are providing Office of Structure Design with our foundation recommendation for the design of the proposed soldier pile wall for permanent repair of the slipout at the above referenced project.

1.1 History

The slipout is located below northbound Route 128, at approximately PM 2.36, about 1 mile north of Hogwarts Way, near the town of Cloverdale in Sonoma County. We visited the site for a field review and we observed the following:

The longitudinal crack of the slipout is about 4 inches wide (maximum) and encroaches into the existing white stripe of the northbound shoulder and is approximately 25 ft long. It also appears that the area of the crack is located at the low point of the roadway that creates water ponding and surface runoff that has saturated the cut/fill slope and undermined the downhill side slope below the roadway causing the development of the cracks on the roadway pavement and eventually causing the slipout.

MS. OFELIA ALCANTARA

Attn: G. Danke

October 19, 2012

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2. PROJECT PURPOSE AND NEED

The need for this project is to permanently repair the landslide and rebuild the roadway at this location. Several alternatives were considered for repairing the slipout such as using proprietary system called Launched Nails, Gabion Wall, segmented pile wall and soldier pile wall. After discussing these options with Design, Headquarters Geometrician and other support units, it was decided that a 12 ft northbound lane and 4 ft shoulder and 4' clearance for the MBGR will be required at this location. This requires that the face of the proposed wall be located at 20 ft offset from the existing Route 128 centerline. Therefore, the most feasible alternative is constructing a soldier pile wall at this location. Refer to the attached (Typical Cross-Section) Figure 1 for details.

3. SCOPE OF WORK

The following tasks were performed for the preparation of this Foundation Report:

- Field mapping
- Field geotechnical exploration, including drilling one boring
- Review of the previously prepared memorandums by this office
- Laboratory testing on selected samples

4. SITE AND REGIONAL GEOLOGY

4.1 Regional and Site Geology

Site Geology

The site lies in northern Sonoma County, in the California Coast Ranges, a northwest-trending band of folded and faulted mountains that roughly parallel the San Andreas fault zone. Sonoma County, like all of California, is highly seismically active. The Maacama Fault, the San Andreas Fault and the Rogers Creek Fault are major faults in Sonoma County. East of the San Andreas Fault, the Cretaceous Franciscan Formation is present throughout much of Sonoma County. The site lies on Franciscan Complex graywacke. The Franciscan Complex is commonly sheared and prone to sliding.

The Franciscan Complex is a "Block in Matrix" rock. It is made up of sheared and folded metamorphic rocks, such as graywacke, chert, and serpentine. Resistant blocks of hard rock are randomly distributed in a soft matrix. Usually, the blocks are serpentine or greenstone (metamorphosed basalt), and the matrix can be argillite (sheared mudstone) or graywacke (sandstone). The blocks are randomly distributed, which means they can range from pebble-sized

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Page 3

to as large as a house, and they do not lie in layers or exhibit any regular structure. Moreover, within blocks, there can be variability in characteristics such as hardness and the degree of fracturing, bedding orientation, etc.

The site lies within a large block of graywacke. (Geologic Map-Figure 2). The rock is highly deformed, with open joints and shears occurring at intervals of 6 inches or less. Bedding is thin to medium. In some places, the rock is unstable because joints and bedding intersect.

4.2 Seismicity

Geologists and seismologists recognize the San Francisco Bay Area as one of the most active seismic regions in the United States. There are 8 faults within 15 miles of the project site. The controlling fault for the project is Maacama fault zone (North section). The Maacama fault lies 3.1 miles (5 kilometers) from the project site. Caltrans ARS tool gives a maximum PGA of 0.566 at a period of 0.01. This PGA was calculated with the USGS Probabilistic model, using the USGS Seismic Hazard Map (2008) and a 975 year return period. Fault data is present in Table 2, and fault locations presented on the attached Fault Map-Figure 3.

Table 2: Fault Data*

Fault Name	Distance: Miles	Fault ID:	Fault Type:	Maximum Magnitude (MMax):
Maacama fault zone (North section)	3.03	366	Right Lateral Strike Slip	7.1
Maacama fault zone (South section)	3.4	367	Right Lateral Strike Slip	7.1
Chianti fault	3.21	335	Right Lateral Strike Slip	6.4
Wight Way	6.4	187	Right Lateral Strike Slip	6.6
Alexander-Redwood Hill fault zone	7.06	327	Right Lateral Strike Slip	6.6
Healdsburg fault	11.3	156	Right Lateral Strike Slip	6.8
Collayomi fault	13.1	336	Right Lateral Strike Slip	6.5
Big Valley fault	14.9	186	Right Lateral Strike Slip	6.2
San Andreas fault zone (North Coast section)	21.8	308	Right Lateral Strike Slip	7.9

*MCE's from Caltrans ARS Online (2010)

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Attn: G. Danke

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4.3 Geologic Hazards

The site may be affected by activity along any of the active faults discussed above. Earthquake induce hazards can be categorized as primary and secondary seismic effects.

Primary seismic effects such as ground rupture or surface deformation resulting from differential movement along a fault trace are not expected to occur. According to the Alquist-Priolo Earthquake Fault Zone Maps, there are no active faults within the project area.

Secondary seismic effects result from various soil responses to ground acceleration. These effects result from activity of any nearby active faults.

- Liquefaction of Natural Ground – Liquefaction is a process by which soil deposits below the water table temporarily lose strength and behave as a viscous liquid rather than a solid, typically during a moderate to large earthquake. In general, very loose to medium dense, clean fine- to medium-grained sand and very soft to firm; low plasticity silts that are relatively free of clay are most susceptible to liquefaction. Earthquake-induced ground shaking can cause these loose or soft materials to densify, resulting in increased pore water pressures and an upward movement of groundwater that may result in a liquefied condition. Depending on the weight of the structure, the depth to the liquefied stratum and the nature of the overlying soils, structures situated above such temporarily liquefied soils may sink or tilt, causing significant structural damage.

According to the Liquefaction Susceptibility Map, the project is located in an area of very low liquefaction susceptibility level (see Figure 4, Liquefaction Susceptibility Map). Additionally, based on the subsurface soil description in section 5 of this report, liquefaction potential is considered to be insignificant.

- Cracking – Lurch cracks may develop in the silty and clayey soil overlying the site. The potential for lurch cracking will be higher in the rainy periods when the soil is saturated. The hazard from cracking is considered minimal.
- Differential Compaction – During moderate and large earthquakes, soft or loose, natural or fill soils can become densified and consolidate, often unevenly across a site. Since loose or soft material was not encountered in our investigation, the potential for differential compaction is minimal.

Ground Shaking - As noted in the Seismicity section above, moderate to large earthquakes are probable along several active faults in the greater Bay Area. Therefore, strong ground shaking

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Page 5

should be expected at some time during the design life of the proposed development. The improvements should be designed in accordance with current earthquake resistant standards.

5. SUBSURFACE SOIL CONDITIONS

One Power boring (A-12-001) was drilled utilizing 6" hollow stem auger drilling method with Standard Penetration Test (SPT) sampling in July 2012, on the northbound lane within the slide area to the depths of 56.5 feet. The boring describe the foundation soils/rocks as approximately 13 feet of stiff to very stiff sandy lean clay (of which there are about 7' of fill). This overlies intensely to medium weathered, very hard igneous rock with shear zone at about 22' below original ground (MSL 527 feet) with stiff to gravelly clay infilling. The remainder of the borings describes the foundation soils/rocks as moderately hard, intensely to decomposed metamorphic rock (Argellite). The unconfined compressive strength of the clayey soil (using a pocket penetrometer) was estimated to range between 2.0 and 3.5 tsf. The SPT blow counts range from 9 to more than 50 (refusal) blows per foot.

Groundwater was encountered in boring A-12-001 at the depth of 55 ft below roadway surface (MSL 494 ft) during drilling. Refer to the attached Log of Test Boring Sheets (LOTB) for details. The LOTB sheets should be included with the contract plans.

6.0 GEOTECHNICAL TESTING

6.1 In-Situ Testing

Laboratory testing was performed on selected samples of the subsurface materials obtained during our subsurface investigation. Tests include performing in-situ pocket penetrometer, moisture content and corrosion testing.

7. CORROSION

The Department considers the site to be corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

Chloride concentration is greater than or equal to 500 ppm, sulfate concentration is greater than or equal to 2000 ppm, or the pH is 5.5 or less.

The following table provides our corrosion test summary:

<i>Boring</i>	<i>SIC Number (TL-101)</i>	<i>Sample Depth</i>	<i>Resistivity (Ohm-Cm)</i>	<i>pH</i>	<i>Chloride Content (ppm)</i>	<i>Sulfate Content (ppm)</i>
A-12-001	C634923	15'-20'	7751	7.25	N/A	N/A

The test results indicate that the site is NOT corrosive to foundation elements.

8. FOUNDATION RECOMMENDATIONS

In order to protect and maintain the roadway, based on the site conditions and the results of our field investigation, we recommend constructing a CIDH soldier piles in northbound direction for a distance of about 90 ft (between approximate Stations 53+20± and 54+10±). The wall will be constructed at 20 ft offset from the existing Route 128 centerline. See attached Exhibit A.

We recommend that the soldier piles be designed to act as a 15 feet-high (max.) cantilever wall with wood lagging where needed. The 15-foot maximum wall height limits are between approximate Station 53+55± and 53+90±.

We recommend that the soldier piles wall be designed for the following:

Lateral Earth Pressures

For *active pressure* against the wall, use the following:

Between 0' and 15' depth:

- Internal friction angle $\phi = 30^\circ$, $C = 1000$ psf & soil moist unit weight (γ) = 120 lb/ft³.
- For earth pressure distribution, use a triangular pressure distribution.
- A rectangular pressure diagram from top of the wall to a depth of 10 ft for traffic surcharge equivalent to about 2 ft of fill.

MS. OFELIA ALCANTARA

Attn: G. Danke

October 19, 2012

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- The wall shall be capable of resisting an additional seismic uniform earth pressure estimated to be equal to $20H$ psf.

For *passive pressure* against the soldier piles, use the following input:

Below Dredge line:

- Internal friction angle $\phi = 36^\circ$, $C = 0$ psf & soil moist unit weight (γ) = 125 lb/ft³.
- Friction Factor = $3/4\phi$
- Use Isolation Factor of 3

Vertical CIDH Pile Capacities and Penetration Depth

Based on the borings, the soldier piles should be embedded (to the competent rock layer) a minimum of 40 feet (pile length) below the roadway surface.

The ultimate vertical compression and tension capacities of piles may be calculated using the following design parameters:

Use a unit pile shaft friction of 1.20 ksf per unit surface area of the pile length below the dredge line of the wall.

Use 60 percent of the compression shaft resistance values mentioned above to calculate the ultimate tension (uplift) resistance of the pile.

For ultimate pile tips compression, use bearing capacity of 100 ksf per unit tip.

The above recommendations are based on parameters established by our field exploration and engineering judgment.

IX. CONSTRUCTION CONSIDERATIONS

The following construction considerations and requirements should be included in the design and construction specifications for the proposed wall.

- Although, groundwater was encountered at the depth of 55 ft below roadway surface (MSL 494 ft) during drilling, groundwater elevation fluctuates seasonally and may be encountered at higher elevation. Thus, caving may be expected and casing may be required.

MS. OFELIA ALCANTARA

Attn: G. Danke

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- The contractor may encounter difficulties during drilling for the soldier pile below 30 ft due to the presence of moderately hard to very hard rock. Proper drilling equipment should be considered for the drilling into hard rock.
- Installation of the CIDH piles should be performed in accordance with Section 49-3 of the 2010 Caltrans Standard Specifications.
- Drilling and concrete placement for CIDH pile construction shall be staggered. No open holes shall be adjacent.

* * * * *

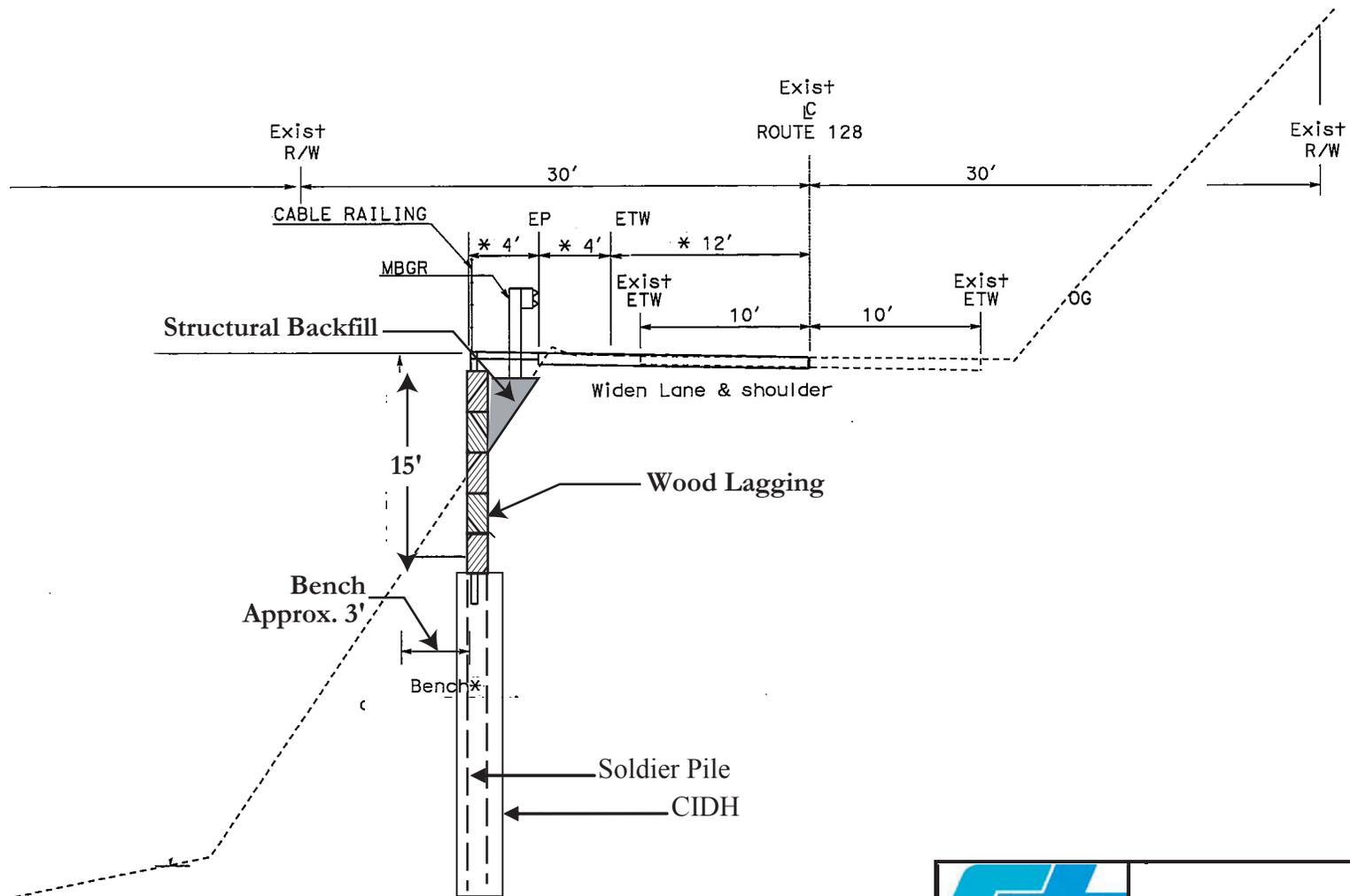
Any questions regarding the above recommendations should be directed to the attention of Ali Kaddoura/Mohammad Zabolzadeh at 510-286-4676/4831 or Hooshmand Nikoui at 510-286-4811, at the Office of Geotechnical Design-West, Branch A.

Attachments:

c: TPokrywka, HNikoui, MZabolzadeh, AKaddoura - (GS West), SRajendra (GS Support-Office Chief), RE_pending_File (Structure Construction), JStayton (DES OE), RWoo (District 04 ME), CCashin Hydraulics (District 04), RMusni PE (District 06 Design PE), HAlmaguer (District 06 PM).

Kaddoura/Zabolzadeh/mm/ SON-128-PM 2.36 FR – 04-1SS220





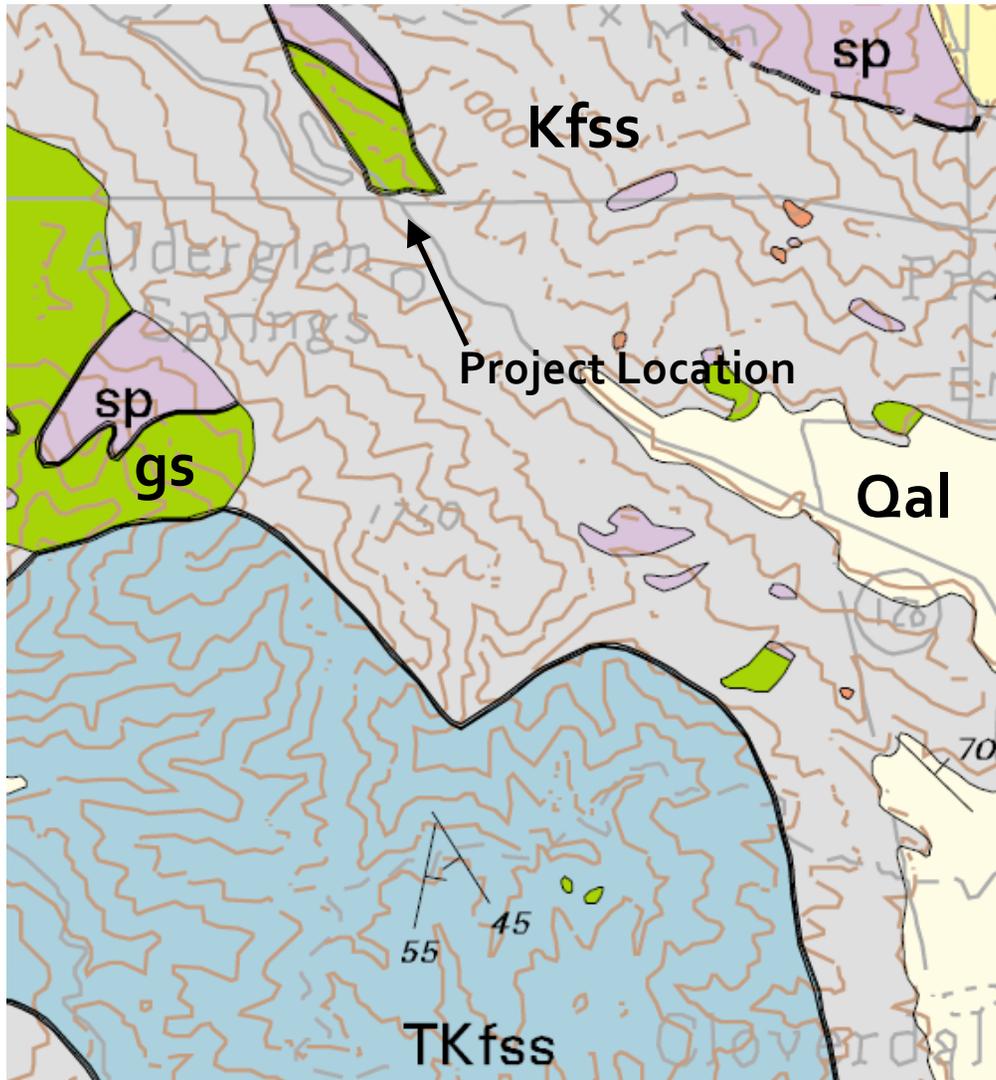
CROSS-SECTION

SOLDIER PILE WALL
HIGHWAY 128 PM 2.36
SONOMA COUNTY, CALIFORNIA

PROJECT NO.
04-1SS220

OCTOBER 2012

FIGURE 1



Key

- Qal Alluvial fan and fluvial deposits (Quaternary)
- Franciscan Complex**
- TKfss Sandstone (late Eocene to Late Cretaceous, Maastrichtian)
- Kfss Sandstone (Late Cretaceous, Turonian to Campanian)
- gs Greenstone block
- sp Serpentine block

MAP TAKEN FROM: U.S. Geological Survey: Geologic Map and Map Database of Western Sonoma, Northernmost Marin, and Southernmost Mendocino Counties, California By M.C. Blake, Jr., R.W. Graymer, and R.E. Stamski, 2002.

SCALE
Not to Scale



**DIVISION OF
ENGINEERING SERVICES**
GEOTECHNICAL SERVICES
GEOTECHNICAL DESIGN - WEST – BRANCH B

GEOLOGIC MAP

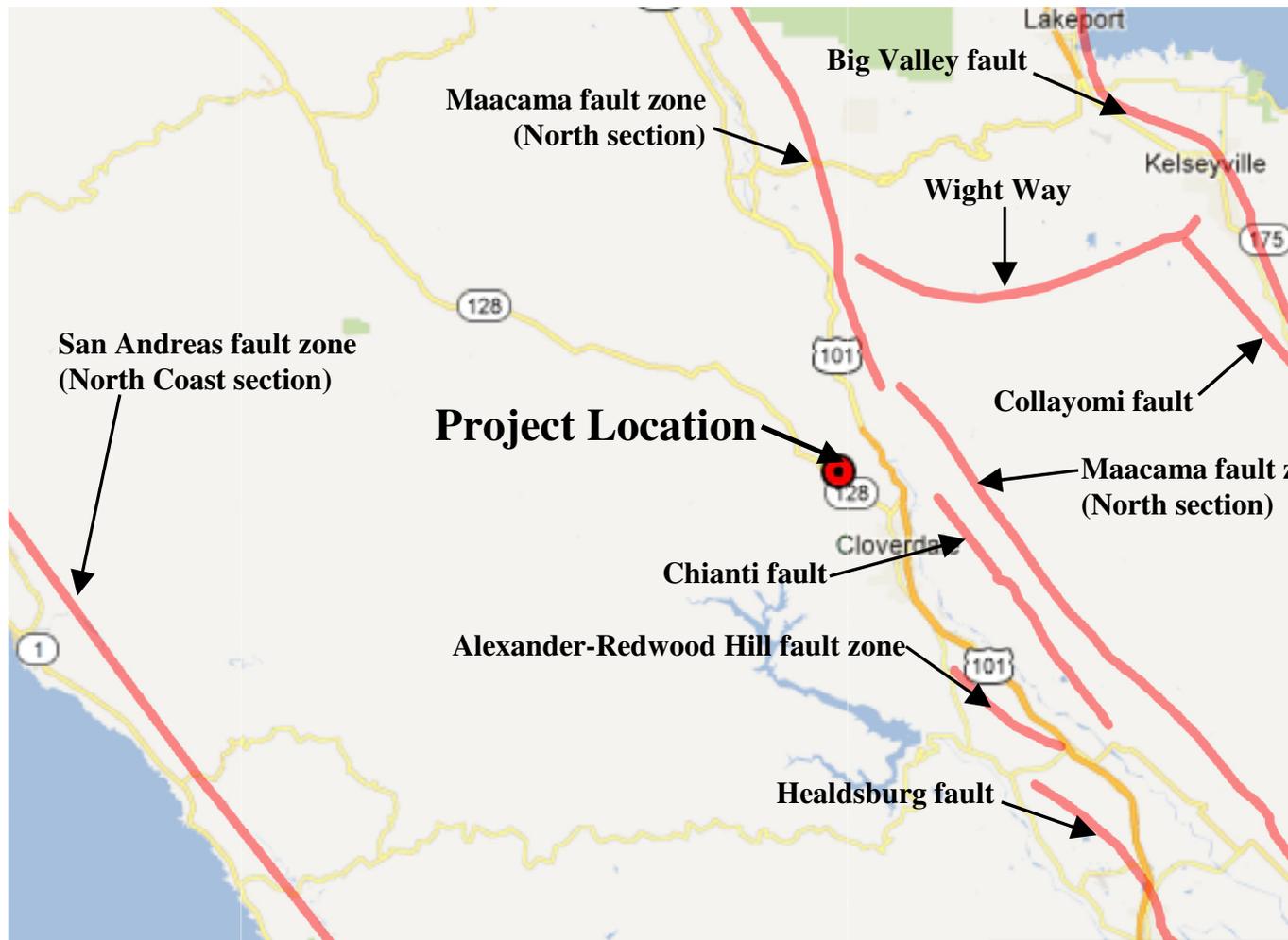
04-SON-128

0400000680

PM. 2.36

OCTOBER 2011

FIGURE 2



MAP TAKEN FROM:
http://dap3.dot.ca.gov/shake_stable/

SCALE
 Not to Scale



**DIVISION OF
 ENGINEERING SERVICES**
 GEOTECHNICAL SERVICES
 GEOTECHNICAL DESIGN - WEST - BRANCH B

ARS Fault Map

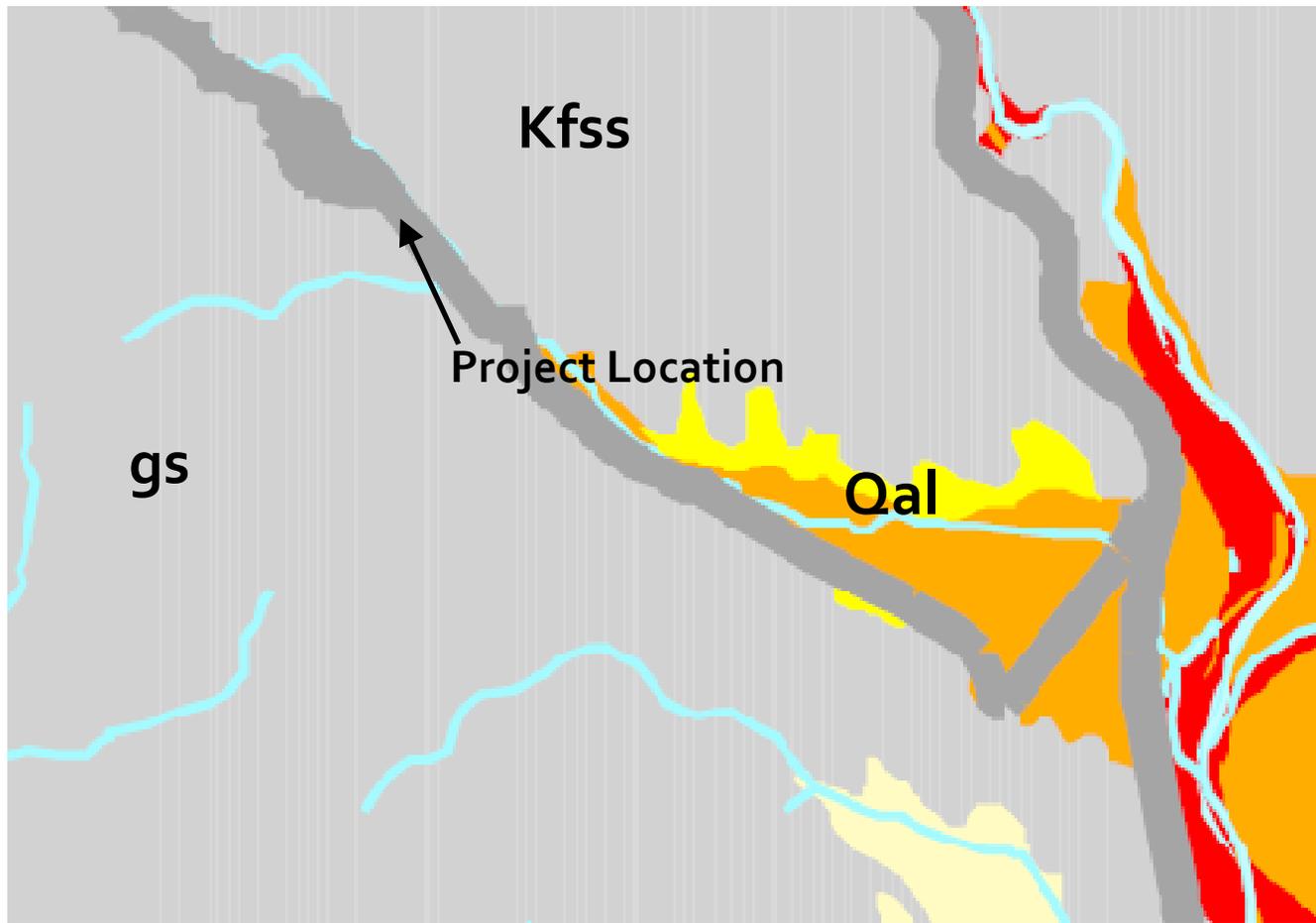
04-SON-128

0400000680

PM. 2.36

OCTOBER 2011

FIGURE 3



Key

-  Major roads
-  County boundaries
- Liquefaction susceptibility**
-  Very high
-  High
-  Medium
-  Low
-  Very low
-  Water
-  Not mapped

MAP TAKEN FROM: http://www.sonoma-county.org/fire/pdf/emergency/sonoma_liq.pdf

SCALE
Not to Scale



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GEOTECHNICAL DESIGN - WEST – BRANCH B

Liquefaction Susceptibility Map

04-SON-128

0400000680

PM. 2.36

OCTOBER 2011

FIGURE 4

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	128	2.36		

Ali Kaddoura 11-19-12
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE: 12-31-12

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

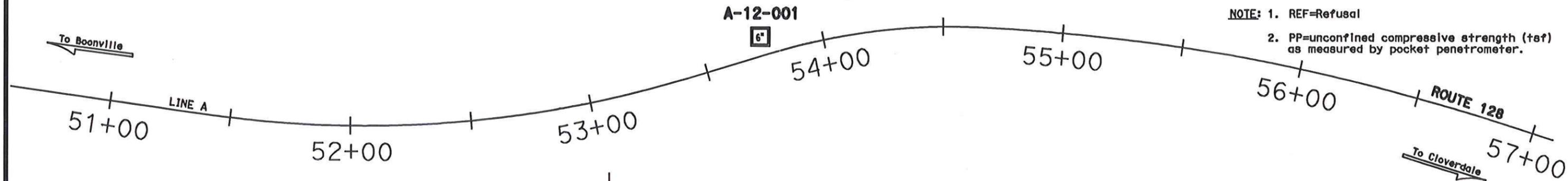
This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, & Presentation Manual (2010 Edition).



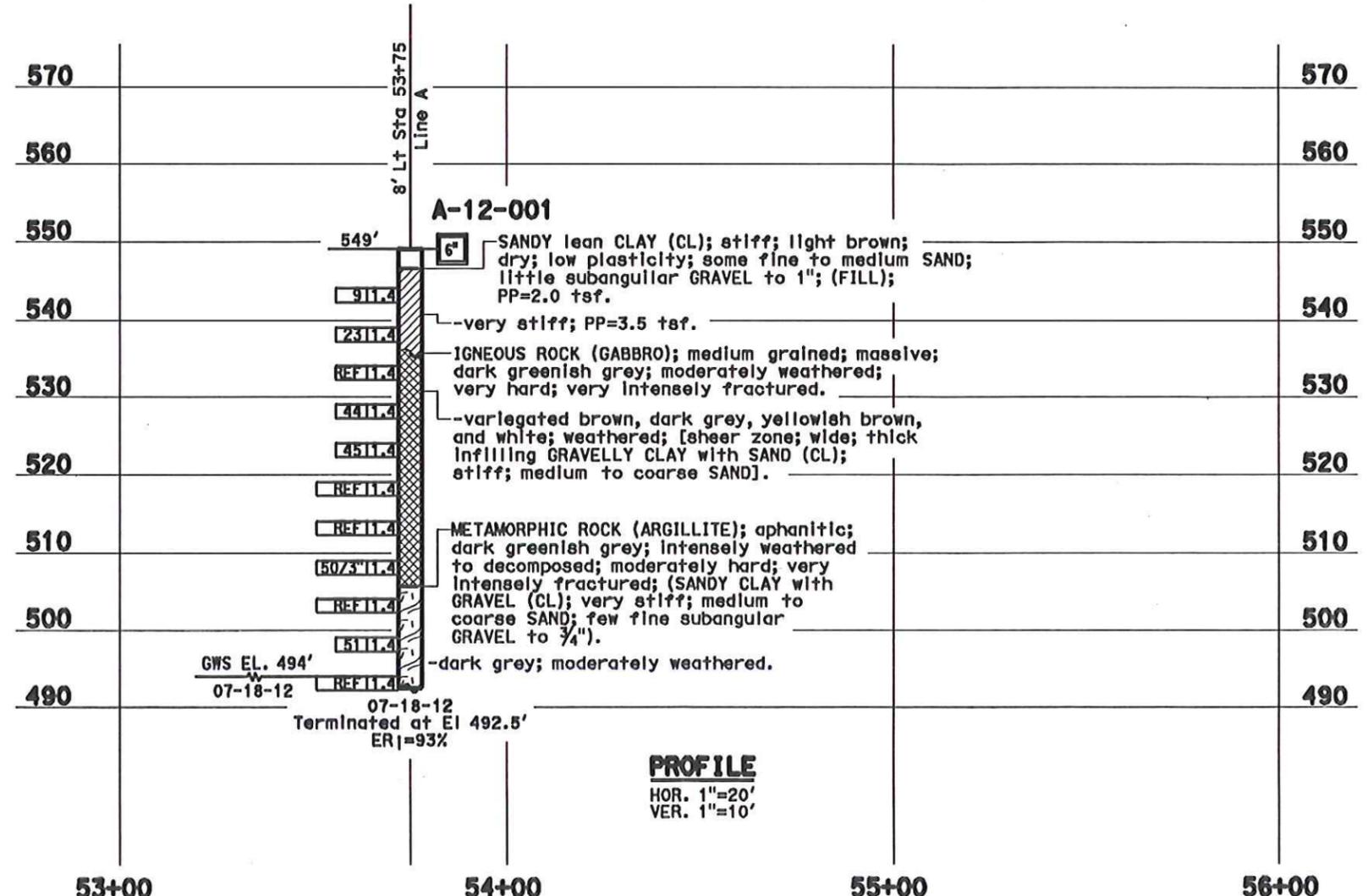
BENCH MARK

SHUV 4

Set 8" Spike, 20' Rt. of Route 128 C on Dirt Shoulder.
N 2,069,292.28
E 6,260,436.91
Elev. 553.33'



- NOTE: 1. REF=Refusal
2. PP=unconfined compressive strength (tsf) as measured by pocket penetrometer.



ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA		DIVISION OF ENGINEERING SERVICES		SOLDIER PILE RETAINING WALL	
FUNCTIONAL SUPERVISOR	DRAWN BY: M. Reynolds 08/12	FIELD INVESTIGATION BY:	A. Kaddoura	DEPARTMENT OF TRANSPORTATION		OFFICE OF GEOTECHNICAL		LOG OF TEST BORINGS 1 of 1	
NAME: H. Nikouli	CHECKED BY: C. Riedon					DESIGN BRANCH			
						UNIT: 3660			
						PROJECT NUMBER & PHASE: 04000208880		CONTRACT No.1 04-1SS220	
						FILE => 41SS220qa01.dgn			

DATE PLOTTED => 14:13
USER NAME => ST10822

Memorandum

*Flex your power!
Be energy efficient!*

To: MR. THANH NGUYEN
Senior, Central Region Design I
Project Development

Date: November 6, 2012

Attention: R. Musni

File: 04-SON-128- PM 2.6
04 – 1SS220
Efis: 0400020888-0
Double Twisted Wire Drapery Mesh
Project

From: THOMAS G. WHITMAN 
Chief, Branch D
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

Subject: Landslide Repair Recommendations

As per your request dated June 22, 2012, we are providing the Office of Design with our recommendation for the design of the proposed Double Twisted Wire Mesh Drapery system and horizontal drains for mitigation of the landslide at the above referenced project.

BACKGROUND/EXISTING CONDITIONS

The landslide is located above southbound Route 128, at approximately PM 2.6, approximately 1.5 mile north of Hogwarts Way, near the town of Cloverdale in Sonoma County. It is our understanding that this landslide occurred during the Winter of 2010.

We visited the site on August 23, 2012 and during the visit, it was noted a shallow landslide had occurred in an over steepened cut slope along the upslope side of the roadway (see Figure 1). This landslide has occurred within the limits of a larger, inactive, older landslide. The current active landslide is classified as a shallow rotational failure that extends upslope from roadway level approximately 90 feet within a 50 degree cut slope and is 55 feet wide at the roadway level, as shown on Figure 2. The material involved in the active landslide consists of highly weathered to decomposed fine to coarse grain sandstone. Landslide debris remains on the slope and will need to be removed as part of this project. Additionally, once the slide debris is removed it is anticipated that much of the slope and head scarp area will be composed of soil and angular cobbles and boulders of sandstone. It is anticipated that slope will shed this material in the form of rockfall and minor debris flows.

The natural slope above the active head scarp was inspected. There is no sign of active landslide movement beyond the limits of the current landslide. No deep seated landsliding was identified at this site during this review.

MR. THANH NGUYEN

Attn: R. Musni

November 6, 2012

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Groundwater springs were observed at the base of the slope.

SCOPE OF WORK

The following tasks were performed for the preparation of this report:

- Field review and mapping
- Review of published materials related to project area
- Review of the previously prepared memorandums by this office

GEOLOGIC CONDITIONS

Regional Geology

The site lies in northern Sonoma County, in the California Coast Ranges, a northwest-trending band of folded and faulted mountains that roughly parallel the San Andreas Fault zone. Sonoma County, like all of California, is highly seismically active. The Maacama fault, the San Andreas Fault and the Rogers Creek fault are major faults in Sonoma County. East of the San Andreas Fault, the Cretaceous Franciscan Formation is present throughout much of Sonoma County. The site lies on Franciscan Complex greywacke (U.S. Geological Survey: Geologic Map and Map Database of Western Sonoma, Northernmost Marin, and Southernmost Mendocino Counties, California By M.C. Blake, Jr., R.W. Graymer, and R.E. Stamski, 2002). The Franciscan Complex is commonly sheared and prone to sliding.

The Franciscan Complex is a "Block in Matrix" rock. It is made up of sheared and folded metamorphic rocks, such as graywacke, chert, and serpentine. Resistant blocks of hard rock are randomly distributed in a soft matrix. Usually the blocks are serpentine or greenstone (metamorphosed basalt), and the matrix can be argillite (sheared mudstone) or graywacke (sandstone). The blocks are randomly distributed, which means they can range from pebble-sized to as large as a house, and they do not lie in layers or exhibit any regular structure. Moreover, within blocks, there can be variability in characteristics such as hardness and the degree of fracturing, bedding orientation, etc.

Site Geology

The site lies within a large block of graywacke. The rock is highly deformed, with open joints and shears occurring at intervals of 6 inches or less. Bedding is thin to medium. In some places, the rock is unstable because joints and bedding intersect.

Soil

Soil at the site is mapped as the Josephine Loam, 30 to 50 percent slope (USDA, <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>). This unit is described as a gravelly

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loam that is 40 to 60 inches in thickness, with bedrock below. The unit is described as well drained and a minimum of 80 inches to groundwater.

Groundwater

No groundwater information is available for the site, but groundwater springs were noted at the base of the slope near or at the toe of the landslide during a number of field visits in the spring and summer of 2011 and 2012. It is anticipated that groundwater is present within the slope and is a contributing factor to the landslide activity at this location.

CONCLUSIONS

Based on the above, we conclude the following:

Based on the field mapping and cross section developed for this project, the landslide activity at this site is shallow in nature and there is no deep seated landslide activity currently present at the site.

Much of the unstable landslide debris remains on the slope.

It is anticipated that Route 128 will continue to be impacted by landslide debris and rockfall, if no mitigation measures are put in place.

RECOMMENDATIONS

The need for this project is to mitigate ongoing landslide from impacting Route 128 and to protect the roadway from rockfall and soil debris flows. Several alternatives were considered for repairing the impacted area such as grading the slope, retaining wall located at base of slope and a no build option. After considering all options, it was decided that the removal of slide debris that remains on the slope and installation of an erosion mat and Double Twisted Wire Mesh Drapery system is the best alternative, as shown in Figure 3.

In addition, it is recommended to install horizontal drains on either side of the active landslide to lower and manage subsurface water that is contributing to the instability of the existing slope, as shown in Figures 1 and 3. The horizontal drains are 70 ft long at 15 ft O.C. The horizontal drains should be installed as per Section 68-3 of the 2010 Standard Specifications. The slots of the horizontal drains should be configured as follows:

<i>Number of Slots (±1 per linear foot)</i>	<i>Width of Slot (inch)</i>	<i>Minimum Opening Per linear foot (square inches)</i>
22	0.050	1.00

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CONSTRUCTION CONSIDERATIONS

The following construction considerations and requirements should be included in the design and construction specifications for the proposed wall.

- The construction of anchors and the double wire mesh drapery system will require an area larger than the active landslide foot print. This mitigation approach requires a reasonable amount of easement on the sides and above the active landslide limits. It is recommended that a minimum of 15 feet beyond the limits of active landsliding be delineated for the purpose of effectively constructing the project. See Figure 1 for Construction Limits.
- The base of the Double Twisted Wire Mesh drapery system needs to be terminated above the elevation of the proposed horizontal drains as shown on Figure 3.
- The contractor may encounter difficulties during drilling for the anchors. The drilling condition will be a mix of soil and rock to hard rock within a few feet from the surface of the slope. Proper drilling equipment should be considered for the anticipated subsurface conditions.
- Installation of the horizontal drains need to be located and installed in a manner that will not impact the Double Twisted Wire Mesh drapery system or normal maintenance operations. Maintenance should be consulted on this matter.
- It is anticipated that groundwater will be encountered during the horizontal drain drilling and installation.

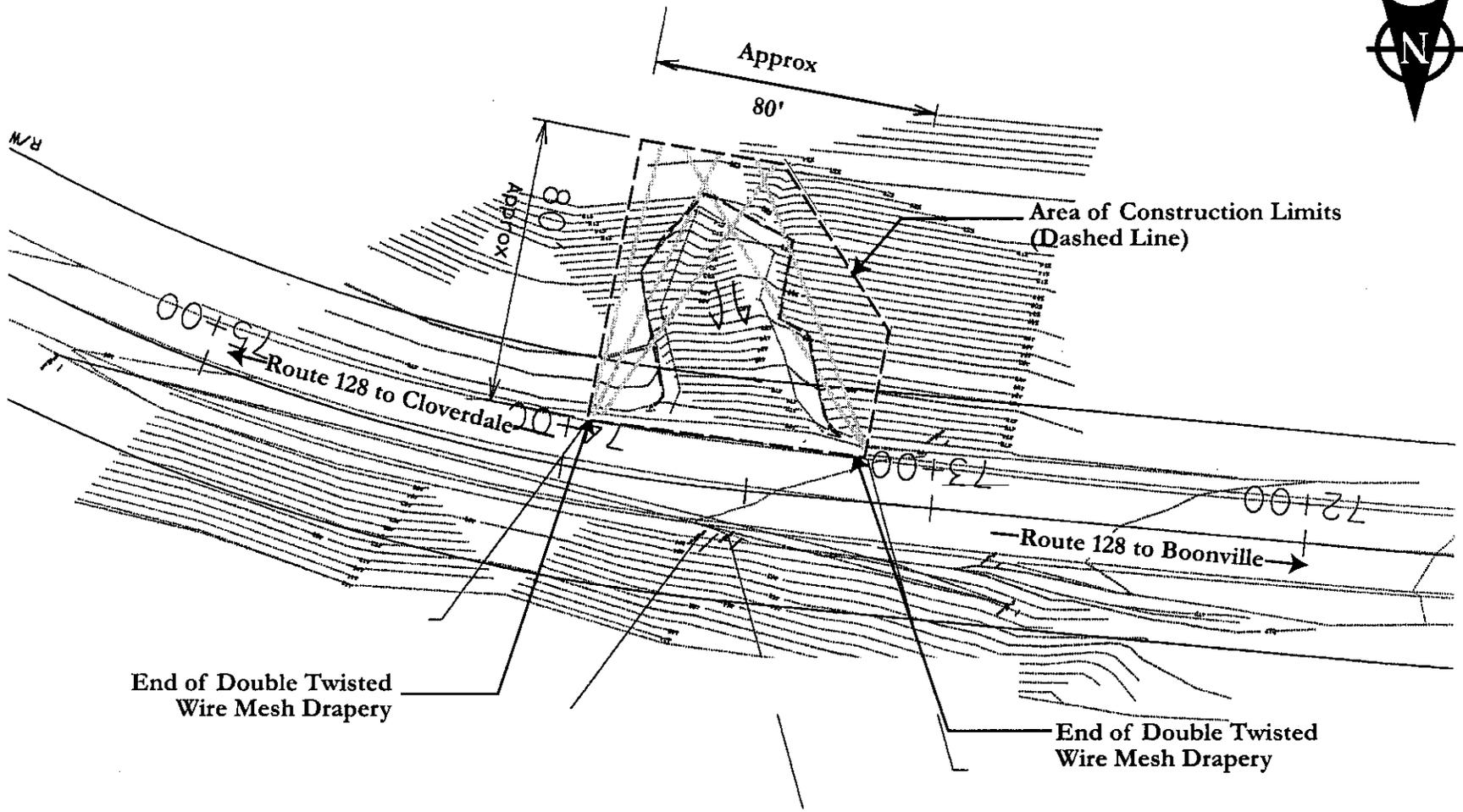
* * * * *

Any questions regarding the above recommendations should be directed to me at 510-286-4848, Office of Geotechnical Design-West, Branch D.

Attachments: Figure 1, Layout
Figure 2, Typical Existing X-Section
Figure 3, Typical Proposed X-Section
Figure 4, Details

c: TPokrywka, HNikoui, MZabolzadeh, AKaddoura - (GS West), EKretschmer

TWhitman/mm

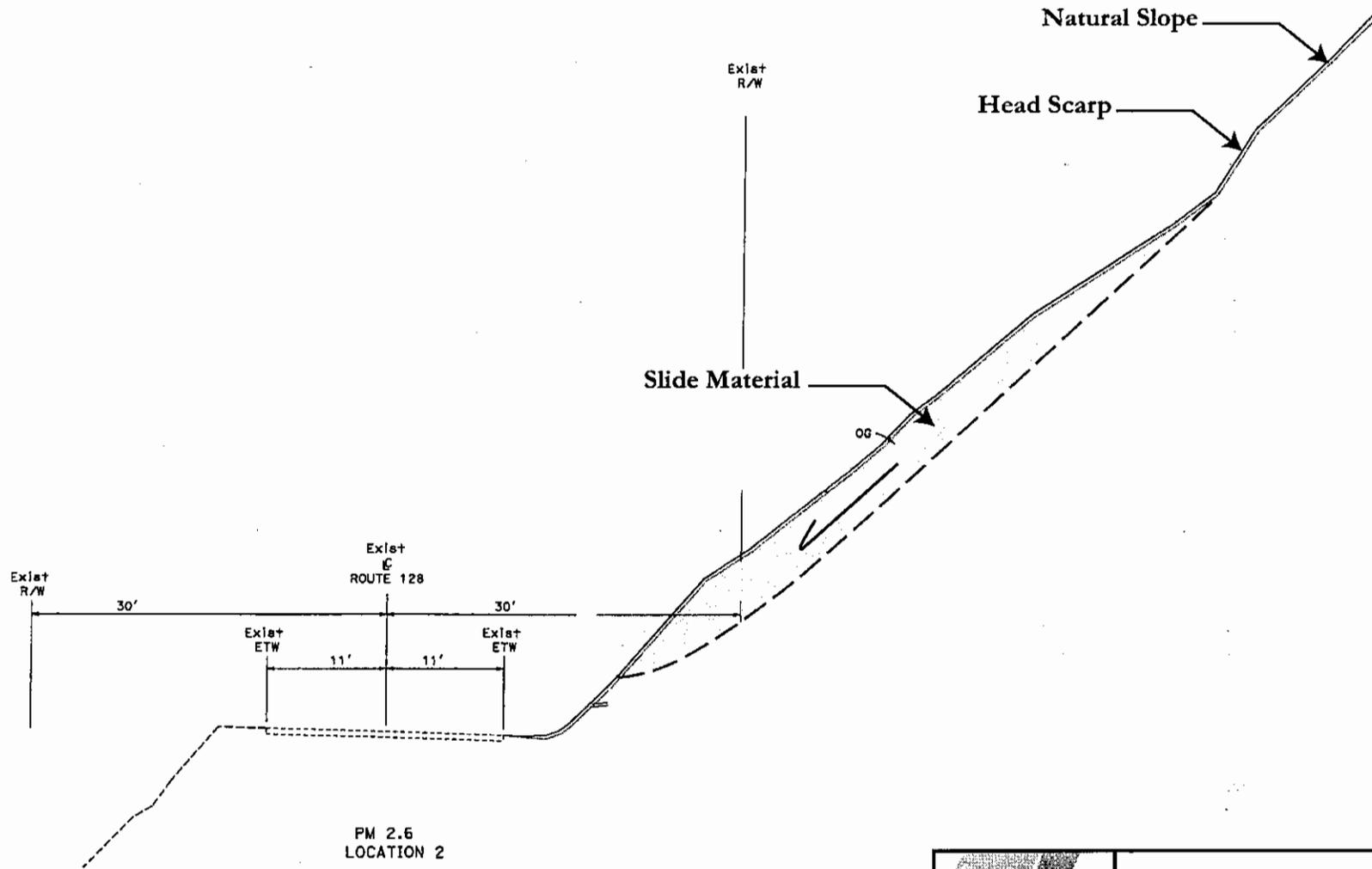


LEGEND



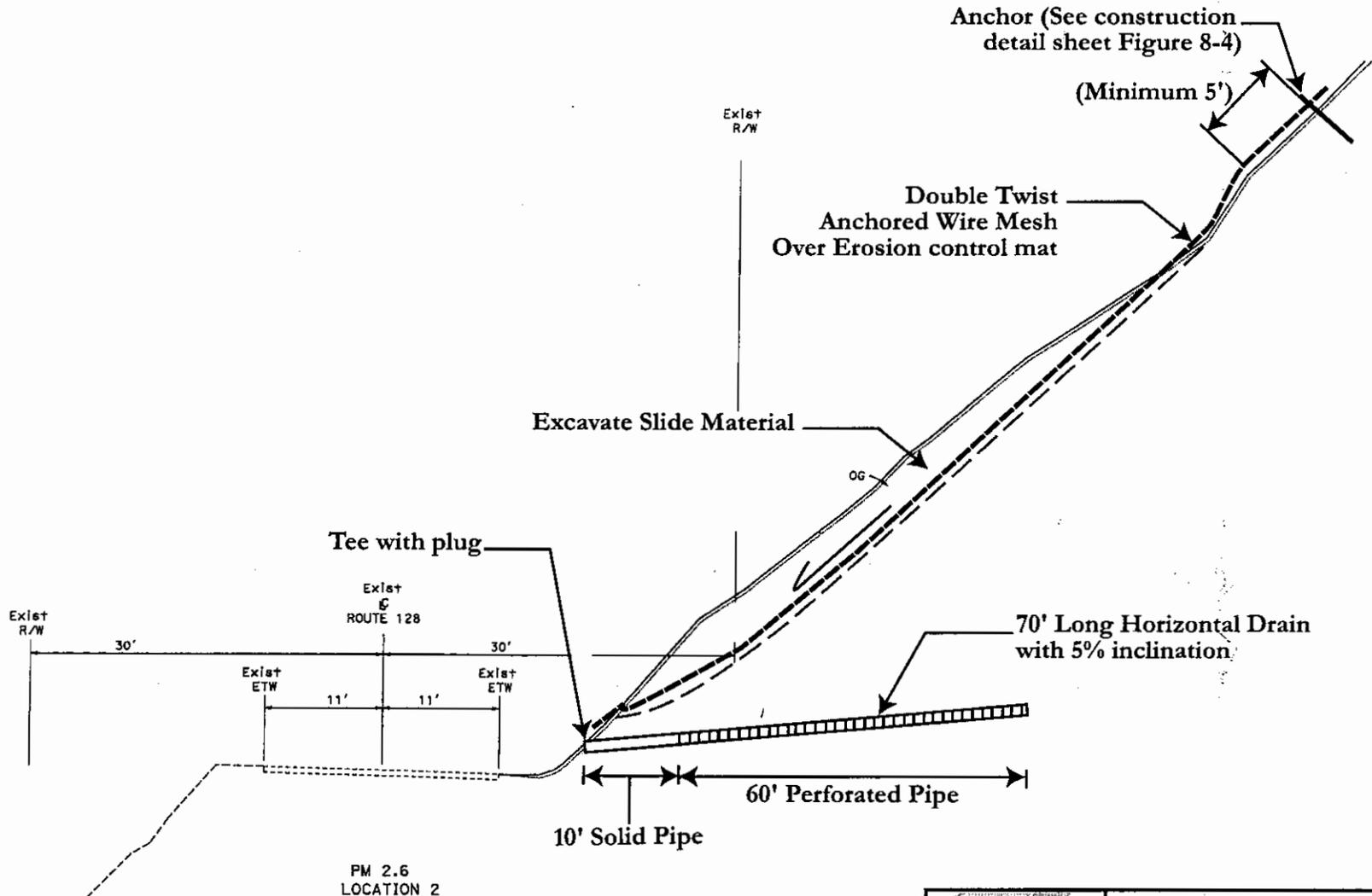
- Approximate area of Landslide, arrows indicate direction of movement
- Approximate Location of Horizontal Drains
- Base: Layout, L-1
- No Scale

	LAYOUT	
	STORM DAMAGE REPAIR HIGHWAY 128 PM 2.60 SONOMA COUNTY, CALIFORNIA	
PROJECT NO. 04-00020888	NOVEMBER 2012	FIGURE 1



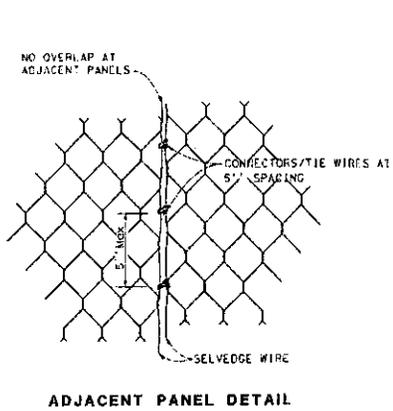
Base: Cross-Section X-1
No Scale

	EXISTING TYPICAL CROSS-SECTION	
	STORM DAMAGE REPAIR HIGHWAY 128 PM 2.60 SONOMA COUNTY, CALIFORNIA	
PROJECT NO. 04-00020888	NOVEMBER 2012	FIGURE 2

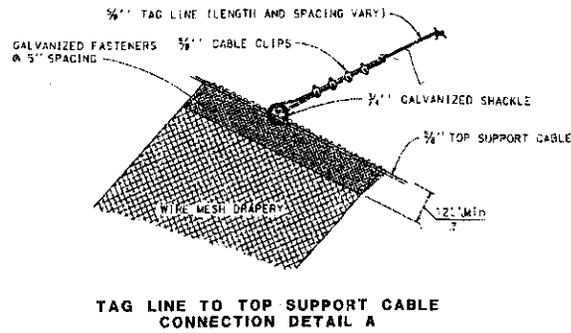


Base: Cross-Section X-1
No Scale

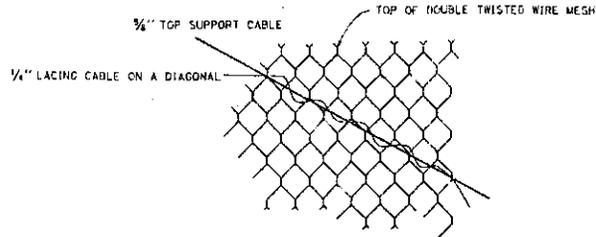
	PROPOSED TYPICAL CROSS-SECTION	
	STORM DAMAGE REPAIR HIGHWAY 128 PM 2.60 SONOMA COUNTY, CALIFORNIA	
PROJECT NO. 04-00020888	NOVEMBER 2012	FIGURE 3



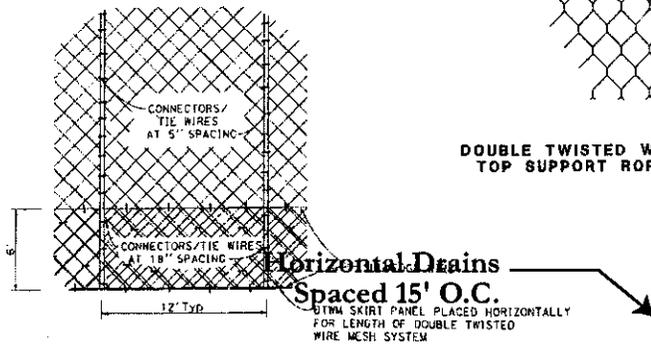
ADJACENT PANEL DETAIL



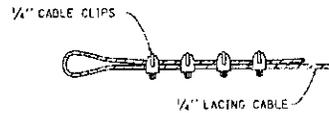
TAG LINE TO TOP SUPPORT CABLE CONNECTION DETAIL A



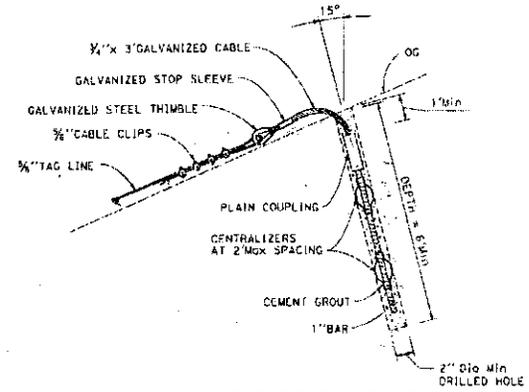
DOUBLE TWISTED WIRE MESH TO DIAGONAL TOP SUPPORT ROPE CONNECTION DETAIL



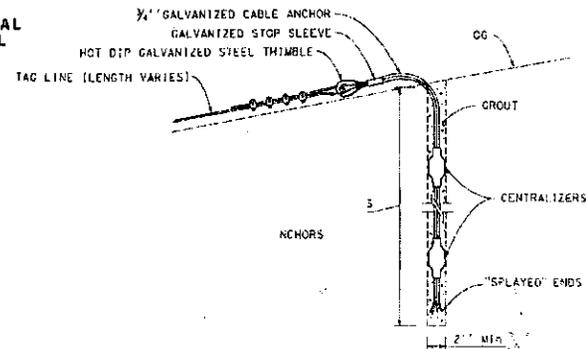
SKIRT PANEL DETAIL



LACING CABLE END DETAIL



ROCK BOLT ANCHOR



CABLE ANCHOR



CONSTRUCTION DETAILS

STORM DAMAGE REPAIR
HIGHWAY 128 PM 2.60
SONOMA COUNTY, CALIFORNIA

PROJECT NO.
04-00020888

NOVEMBER 2012

FIGURE 4

Base: Layout, L-1
No Scale

ET-31™ Guardrail End Treatment

Product Description Assembly Manual

Part No. 620182B

Created January 2013



TRINITY
HIGHWAY PRODUCTS
ENERGY ABSORPTION SYSTEMS

ET-31™ Guardrail End Treatment

Product Description Assembly Manual



2525 Stemmons Freeway
Dallas, Texas 75207



Important: These instructions are to be used only in conjunction with the assembly, maintenance, and repair of the ET-31™ Guardrail End Treatment. These instructions are for standard assembly specified by the appropriate highway authority only. In the event the specified system assembly, maintenance, or repair would require a deviation from standard assembly parameters, contact the appropriate highway authority engineer. This system has been determined to meet the criteria for eligibility for reimbursement by the Federal Highway Administration for use on the national highway system under strict criteria utilized by that agency. A Trinity Highway Products, LLC representative is available for consultation if required.

This Manual must be available to the worker overseeing and/or assembling the product at all times. For additional copies, contact Trinity Highway Products at (888) 323-6374 or download from the website listed below.

The instructions contained in this Manual supersede all previous information and Manuals. All information, illustrations, and specifications in this Manual are based on the latest ET-31™ Guardrail End Treatment information available to Trinity Highway Products at the time of printing. We reserve the right to make changes at any time. Please contact Trinity Highway Products to confirm that you are referring to the most current instructions.

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Customer Service Contacts

Trinity Highway Products, LLC is committed to the highest level of customer service. Feedback regarding the ET-31™ Guardrail End Treatment, its assembly procedures, supporting documentation, and performance is always welcome. Additional information can be obtained from the contact information below.

Trinity Highway Products:

Telephone:	(888) 323-6374 (U.S. Calls) (214) 589-8140 (International Calls)
Fax:	(214) 589-8423
E-mail:	product.info@trin.net
Internet: Trinity Highway Products, LLC	http://www.highwayguardrail.com

Regional Telephone Contacts:

Dallas, Texas	(800) 527-6050
Centerville, Utah	(800) 772-7976
Elizabethtown, Kentucky	(800) 282-7668
Girard, Ohio	(800) 321-2755
Orangeburg, South Carolina	(800) 835-9307
International	+1 214-589-8140

Important Introductory Notes

Proper assembly of the ET-31™ Guardrail End Treatment is essential to achieve performance of the system under appropriate federal and state criteria. These instructions should be read in their entirety and understood before assembling the ET-31™ Guardrail End Treatment. These instructions are to be used only in conjunction with the assembly of the ET-31™ Guardrail End Treatment and are for standard assemblies only as specified by the applicable highway authority. In the event your system assembly requires or involves deviation from standard parameters or, during the assembly process a question arises, please contact the appropriate highway authority that specified this system at this particular location for guidance. Trinity Highway Products is available for consultation with that agency. These instructions are intended for an individual who is qualified to both read and accurately interpret them as written. They are intended for the individual who is experienced and skilled in the assembly of highway products which are specified and selected by the highway authority.



Important: Read safety instructions thoroughly and follow the assembly directions and suggested safe practices before assembling, maintaining, or repairing the ET-31™ Guardrail End Treatment. Failure to follow this warning can result in serious injury or death to workers and/or bystanders. It further compromises the acceptance of this system by the FHWA. Please have these instructions available for use and reference by anyone involved in the assembly of the product.



Warning: Ensure that all of the ET-31™ Guardrail End Treatment Warnings, Cautions, and Important Statements within the ET-31™ Guardrail End Treatment Manual are completely followed. Failure to follow this warning could result in serious injury or death in the event of a collision.

Recommended Safety Rules ET-31™ Guardrail End Treatment

*** Important Safety Instructions ***

This Manual must be kept in a location where it is readily available to persons who are skilled and experienced in the assembly, maintenance, or repair of the ET-31™ Guardrail End Treatment system. Additional copies of this Manual are immediately available from Trinity Highway Products by calling (888) 323-6374 or by email at product.info@trin.net. This Manual may also be downloaded directly from the websites indicated below. Please contact Trinity Highway Products if you have any questions concerning the information in this Manual or about the ET-31™ Guardrail End Treatment.

Always use appropriate safety precautions when operating power equipment and when moving heavy equipment or the ET-31™ Guardrail End Treatment components. Gloves, safety goggles, steel toe boots, and back protection should be used.

Safety measures incorporating traffic control devices specified by the highway authority must be used to provide safety for personnel while at the assembly, maintenance, or repair site.

Safety Symbols

This section describes the safety symbols that appear in this ET-31™ Guardrail End Treatment Manual. Read the Manual for complete safety, assembly, operating, maintenance, repair, and service information.

<u>Symbol</u>	<u>Meaning</u>
---------------	----------------



Safety Alert Symbol: Indicates Danger, Warning, Important, or Caution. Failure to read and follow Danger, Warning, Safety, or Important Statement indicators could result in serious injury or death to workers and/or bystanders.

Warnings and Cautions

Read all instructions before assembling, maintaining, or repairing the ET-31™ Guardrail End Treatment.



Warning: Do not assemble, maintain, or repair the ET-31™ Guardrail End Treatment until you have read this Manual thoroughly and completely understand it. Ensure that all Warnings, Cautions, and Important Statements within the Manual are completely followed. Please call Trinity Highway Products at (888) 323-6374 if you do not understand these instructions. Failure to follow this warning could result in serious injury or death.



Warning: Safety measures incorporating appropriate traffic control devices specified by the highway authority must be used to protect all personnel while at the assembly, maintenance, or repair site. Failure to follow this warning could result in serious injury or death.



Warning: Use only Trinity Highway Products parts that are specified herein for the ET-31™ Guardrail End Treatment for assembling, maintaining, or repairing the ET-31™ Guardrail End Treatment. **Do not utilize or otherwise comingle parts from other systems** even if those systems are other Trinity Highway Products systems. Such configurations have not been tested, nor have they been accepted for use. Assembly, maintenance, or repairs using unspecified parts or accessories is strictly prohibited. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact with an UNACCEPTED system.



Warning: Do NOT modify the ET-31™ Guardrail End Treatment in any way. Failure to follow this warning could result in serious injury or death.



Warning: Ensure that the ET-31™ Guardrail End Treatment and delineation used meet all federal, state, specifying agency, and local specifications. Failure to follow this warning could result in serious injury or death.



Warning: Ensure that your assembly meets all appropriate Manual on Uniform Traffic Control Devices (MUTCD) and local standards. Failure to follow this warning could result in serious injury or death.



Warning: Be aware of hazards of using compressed air (small objects may become projectiles). Failure to follow this warning can result in serious injury or death to the workers and/or bystanders.



Warning: DO NOT perform assembly, maintenance, or repair, if the ET-31™ Guardrail End Treatment site, shoulder, or traveled area is covered or encroached by road debris. Failure to follow this warning could result in serious injury or death in the event of a collision.



Warning: Ensure that the entire work zone site is well lighted at all times. Failure to follow this warning could result in serious injury or death to the workers and/or bystanders.



Warning: Use caution when working near public roads. Be mindful of vehicles in motion nearby. Failure to follow this warning could result in serious injury or death to the workers and/or bystanders.



Warning: Safety measures, incorporating traffic control devices, must be used to protect all personnel, while at the assembly, maintenance, or repair site. Failure to follow this warning could result in serious injury or death to the workers and/or bystanders. Trinity Highway Products offers an economical and effective truck mounted attenuator, the MPS-350, for the protection of workers in work zones. For more information on the MPS-350, call (888) 323-6374 or visit the Trinity Highway Products website at www.highwayguardrail.com.



Warning: Ensure that all guardrail products and delineation meet all federal, state or specifying agency, and local specifications. Failure to follow this warning could result in serious injury or death in the event of a collision.



Warning: DO NOT place a Steel Yielding Treatment Post (SYTP™) at location No. 1. Failure to follow this warning could result in serious injury or death in the event of a collision.



Warning: DO NOT place a Wood 6' 0" long Controlled Release Terminal (CRT) post at location No. 1. Failure to follow this warning could result in serious injury or death in the event of a collision.



Warning: DO NOT bolt the Rail Panel in any fashion to the Post at location No. 1 in any of the ET-31™ Guardrail End Treatments. Doing so may impede the extrusion of the rail through the Head.

Note: The Head is attached to the No. 1 Post with an upper and lower 3/8" diameter fastener that has been shown to shear during impact within NCHRP 350 criteria.

Failure to follow this warning could result in serious injury or death in the event of a collision



Warning: Ensure that there is proper site grading for tube and post placement, as dictated by the state or specifying agency, pursuant to FHWA acceptance. Failure to follow this warning could result in serious injury or death in the event of a collision.



Warning: Ensure that the proper leaveout (the specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement for any posts. Surrounding posts with rigid pavement such as any thickness of concrete or asphalt will prevent post movement in the soil and is NOT allowed. Failure to follow this warning could result in serious injury or death in the event of a collision.



Warning: Ensure that all of the ET-31™ Guardrail End Treatment Warnings, Cautions, and Important Statements within the ET-31™ Guardrail End Treatment Manual are completely followed. Failure to follow this warning could result in serious injury or death in the event of a collision.



Warning: Always use safety precautions when performing assembly, maintenance or repair, mixing chemicals, and/or moving heavy equipment. Wear steel toe shoes, gloves, safety goggles, and back protection. Failure to follow this warning could result in serious injury or death to the workers and/or bystanders.



Warning: Ensure all Wood Blocks or Composite Blocks used with Steel Posts are routed to establish a fixed vertical orientation relative to the Posts. Failure to follow this warning could result in serious injury or death in the event of a collision.



Warning: Ensure that this assembly conforms with the guidance provided by the *AASHTO Roadside Design Guide*, including, but not limited to, those regarding placement on curbs or islands. Failure to follow this warning could result in serious injury or death in the event of a collision.



Warning: Any grout, backfill, or other materials (such as concrete, asphalt, or soil) must be low enough so as not to obstruct, constrain, or otherwise engage the Bearing Plate. Failure to eliminate the interaction of soil or materials with the Bearing Plate will hinder the performance of the ET-31™ Guardrail End Treatment and could result in serious injury or death in the event of a collision.



Caution: Ensure before assembling, maintaining, or repairing the ET-31™ Guardrail End Treatment that no parts are frayed, damaged, or broken. Failure to follow this warning could result in serious injury to the workers and/or bystanders.



Warning: Do not place anything under the rail to post bolt head that would prevent the bolt from pulling through the Rail Panel. Failure to follow this warning could result in serious injury or death in the event of a collision.

Know Your ET-31™ Guardrail End Treatment

ET-31™ Guardrail End Treatment NCHRP Report 350 Test Level 3 System Length 34'-4 1/2" (10.48 m)

For specific assembly, maintenance, or repair details refer to the state or specifying agency's standard drawings and/or Trinity Highway Products standard layout drawings.

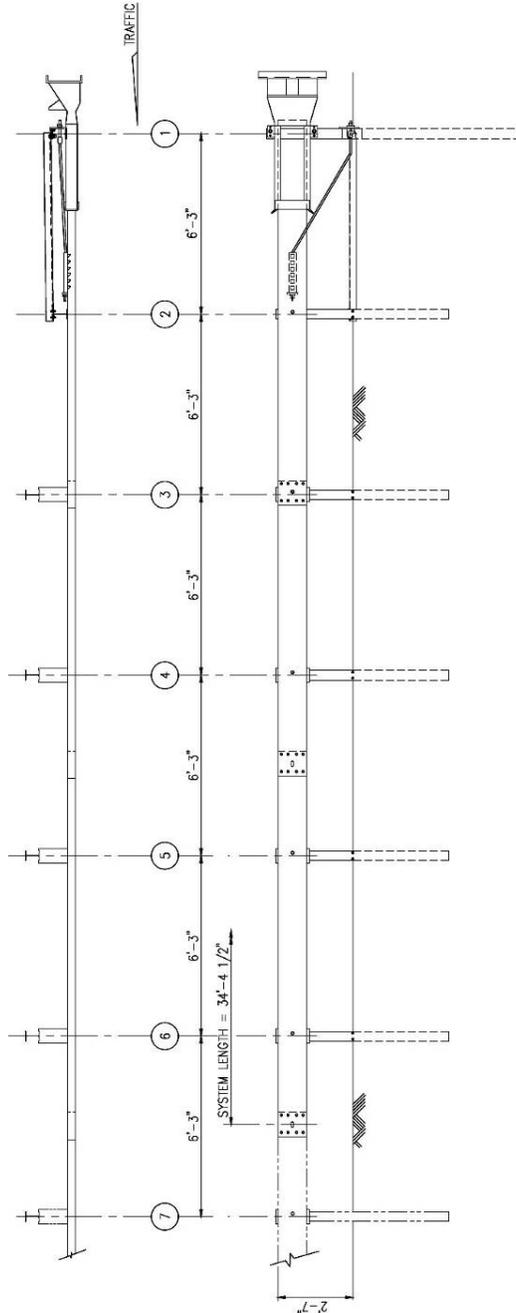


Figure 1 (TL-3)

[This drawing represents one version of the 34'-4 1/2" (10.48 m) system]

Alternative Post Combinations

At Post locations 1 and 2, the alternates to HBA Post at location 1 and 6' Steel Yielding Treatment Post (SYTP) at location 2 are:

	Post Location 1	Post Location 2
Option 1	HBA Post	Short Foundation Tube with SYT Post Insert
Option 2	Long Foundation Tube with Wood Post insert	6' SYTP or short Foundation Tube with SYT Post Insert
Option 3	Long foundation Tube with Wood Post Inserts	Long foundation Tube with Wood Post Inserts
Option 4	Short Foundation Tube with Soil Plate and Wood Post Inserts	Short Foundation Tube with Soil Plate and Wood Inserts
Option 5	Long Foundation Tube with Wood Post Inserts or Short Foundation Tube with Soil Plate and Wood Post Inserts	6' SYTP or Short Foundation Tube with SYT Post Insert

For post locations 3 through 6, alternates to 6' SYT posts are:

- All Short Tubes with Wood Post Inserts
- All 6' Wood CRT Posts
- All Short Foundation Tubes with SYT Post Insert
- Any combination of above options, as accepted by the FHWA and dictated by the state or specifying agency

**ET-31™ Guardrail End Treatment
NCHRP Report 350 Test Level 3
System Length 40'-7 1/2" (12.35 m)**

For specific assembly, maintenance, or repair details refer to the state or specifying agency's standard drawings and/or Trinity Highway Products standard layout drawings.

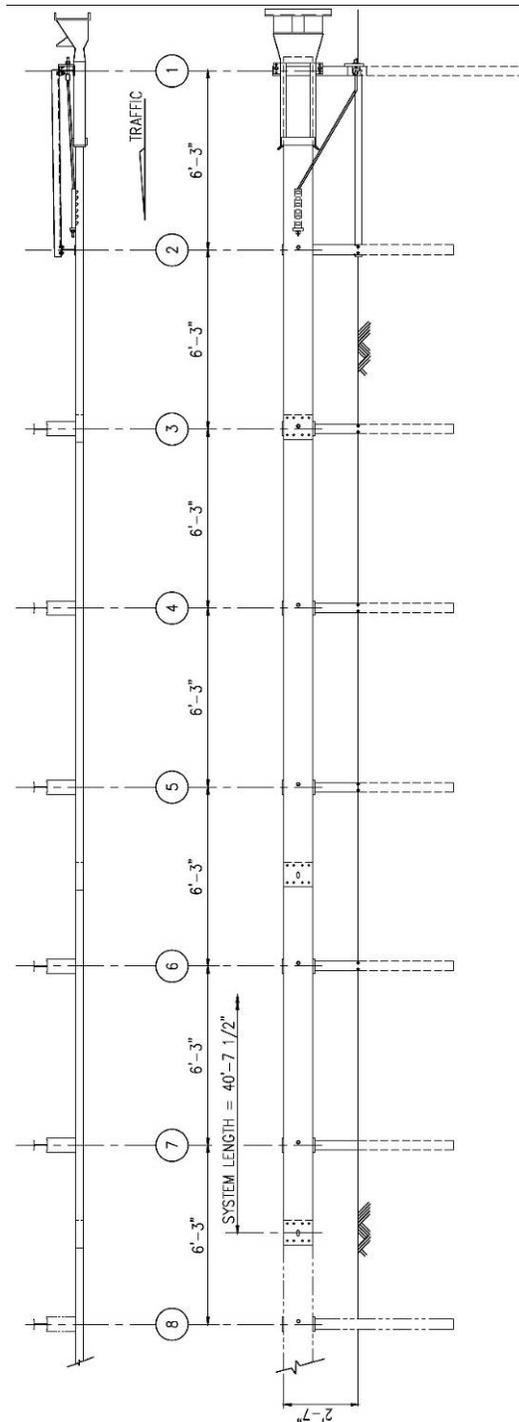


Figure 2 (TL-3)

[This drawing represents one version of the 40'-7 1/2" (12.38 m) system]

Alternative Post and Rail Panel Combinations

At Post locations 1 and 2, the alternates to HBA Post at location 1 and 6' Steel Yielding Treatment Post (SYTP) at location 2 are:

	Post Location 1	Post Location 2
Option 1	HBA Post	Short Foundation Tube with SYT Post insert
Option 2	Long Foundation Tube with Wood Post insert	6' SYTP or short foundation Tube with SYT Post insert
Option 3	Long Foundation Tube with Wood Post Inserts	Long foundation Tube with Wood Post Inserts
Option 4	Short Foundation Tube with soil plates and Wood Post Inserts	Short Foundation Tube with soil plates and Wood Inserts
Option 5	Long foundation Tube with soil Post insert or Short Foundation Tube with soil plate and Wood Post Inserts	6' SYTP or Short Foundation Tube with SYT Post insert

For Post locations 3 through 6, alternates to 6' SYT Posts are:

- All Short Tubes with Wood Post Inserts
- All 6' Wood CRT Posts
- All Short Foundation Tubes with SYT Post insert
- Any combination of above options as accepted by the FHWA and dictated by the state or specifying agency

For Post location 7:

- Steel or Wood line Post dictated by the state or specifying agency

**ET-31™ Guardrail End Treatment
NCHRP Report 350 Test Level 3
System Length 46'-10 1/2" (14.29 m)**

For specific assembly, maintenance, or repair details refer to the state or specifying agency's standard drawings and/or Trinity standard layout drawings.

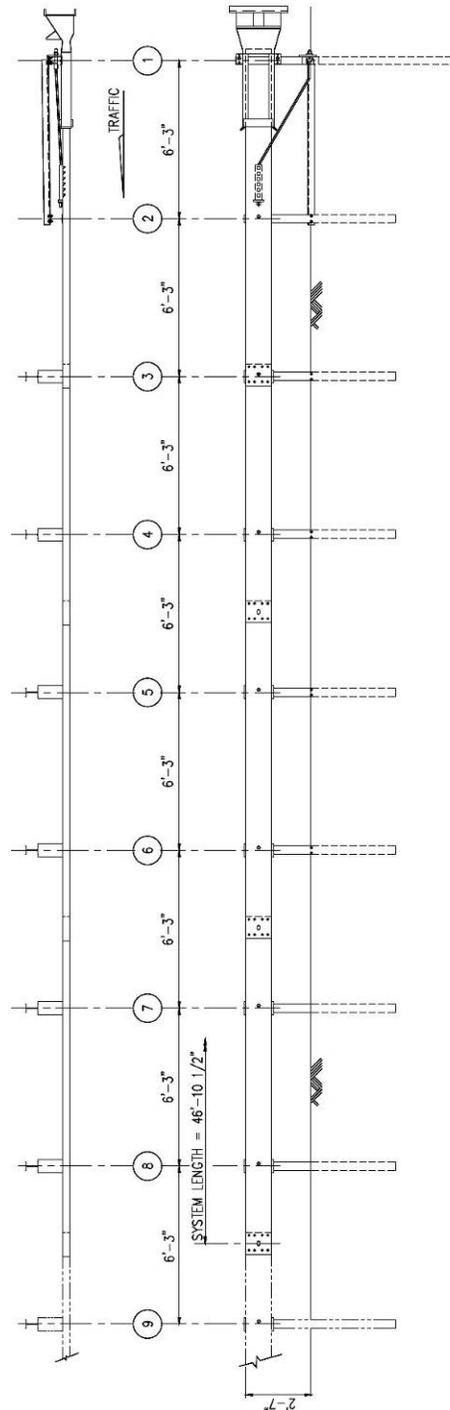


Figure 3 (TL-3)

[This drawing represents one version of the 46'-10 1/2" (14.29 m) system]

Alternative Post and Rail Panel Combinations

At Post locations 1 and 2, the alternates to HBA Post at location 1 and 6' Steel Yielding Treatment Post (SYTP) at location 2 are:

	Post Location 1	Post Location 2
Option 1	HBA Post	Short Foundation Tube with SYT Post insert
Option 2	Long Foundation Tube with Wood Post Insert	6' SYTP or Short Foundation Tube with SYT Post Insert
Option 3	Long Foundation Tube with Wood Post Inserts	Long foundation Tube with Wood Post Inserts
Option 4	Short Foundation Tube with soil plates and Wood Post Inserts	Short Foundation Tube with Soil Plates and Wood Post Inserts
Option 5	Long Foundation Tube with Wood Post Inserts or Short Foundation Tube with Soil Plates and Wood Post Inserts	6' SYTP or Short Foundation Tube with SYT Post Insert

The alternate to two 12' 6" (3.81 m) long rail elements is one 25' 0" (7.62 m) long rail element.

For Post locations 3 through 6, alternates to 6' SYT Posts are:

- All Short Tubes with Wood Post Inserts
- All 6' Wood CRT Posts
- All Short Foundation Tubes with SYT Post insert
- Any combination of above options, as accepted by the FHWA and dictated by the state or specifying agency

For Post location 7 and 8:

- Steel or Wood line Post dictated by the state or specifying agency

**ET-31™ Guardrail End Treatment
NCHRP Report 350 Test Level 3
System Length 53'-1 1/2" (16.19 m)**

For specific assembly, maintenance, or repair details refer to the state or specifying agency's standard drawings and/or Trinity standard layout drawings.

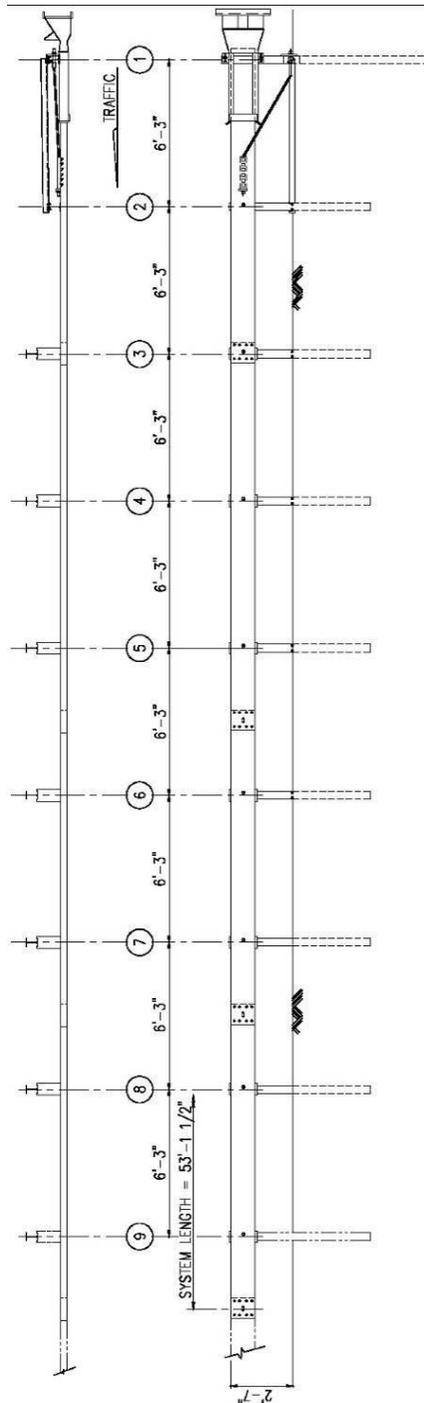


Figure 4 (TL-3)

[This drawing represents one version of the 53'-1 1/2" (16.19 m) system]

Alternative Post and Rail Panel Combinations

At Post locations 1 and 2, the alternates to HBA Post at location 1 and 6' Steel Yielding Treatment Post (SYTP) at location 2 are:

	Post Location 1	Post Location 2
Option 1	HBA Post	Short Foundation Tube with SYT Post insert
Option 2	Long Foundation Tube with Wood Post insert	6' SYTP or Short Foundation Tube with SYT Post Insert
Option 3	Long Foundation Tubes with Wood Post Inserts	Long foundation Tubes with Wood Post Inserts
Option 4	Short Foundation Tubes with Soil Plates and Wood Post Inserts	Short Foundation Tubes with Soil Plates and Wood Post Inserts
Option 5	Long Foundation Tube with Wood Post Inserts or Short Foundation Tube with Soil Plates and Wood Post Inserts	6' SYTP or Short Foundation Tube with SYT Post Insert

The alternate to two 12' 6" (3.81 m) long Rail Panel elements is one 25' 0" (7.62 m) long Rail Panel element.

For Post locations 3 through 6, alternates to 6' SYT Posts are:

- All Short Tubes with Wood Post Inserts
- All 6' Wood CRT Posts
- All Short Foundation Tubes with SYT Post Insert
- Any combination of above options, as accepted by the FHWA and dictated by the state or specifying agency

For Post location 7 through 9:

- Steel or Wood line Post dictated by the state or specifying agency

**ET-31™ Guardrail End Treatment
NCHRP Report 350 Test Level 2
System Length 21'-10 1/2" (6.68 m)**

For specific assembly, maintenance, or repair details refer to the state or specifying agency's standard drawings and/or Trinity Highway Products standard layout drawings.

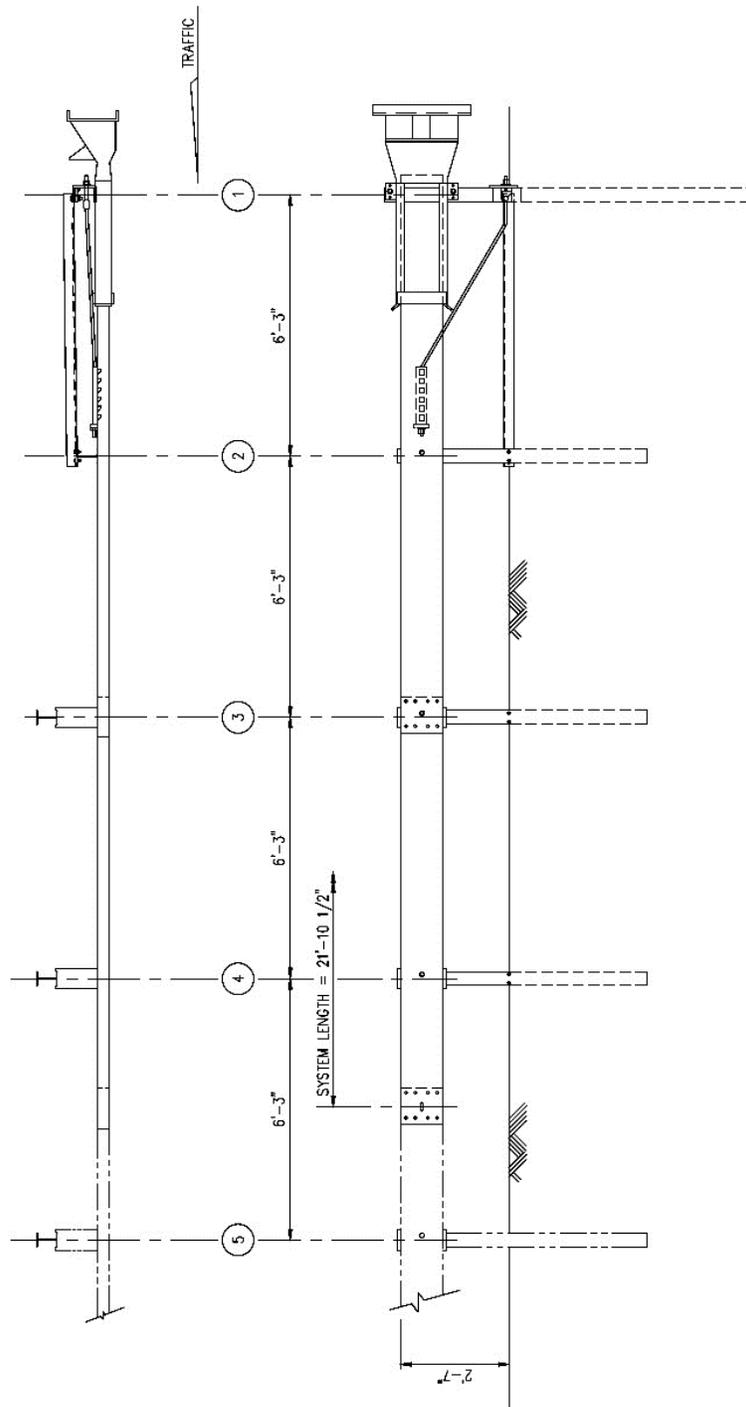


Figure 5 (TL-2)

[This drawing represents one version of the 21'-10 1/2" (6.68 m) system]

Alternative Post Combinations

At Post locations 1 and 2, the alternates to HBA Post at location 1 and 6' Steel Yielding Treatment Post (SYTP) at location 2 are:

	Post Location 1	Post Location 2
Option 1	HBA Post	Short Foundation tube with SYT Post Insert
Option 2	Long Foundation Tube with Wood Post Insert	6' SYTP or Short Foundation Tube with SYT Post Insert
Option 3	Long Foundation Tubes with Wood Post Inserts	Long Foundation Tubes with Wood Post Inserts
Option 4	Short Foundation Tubes with Soil Plates and Wood Post Inserts	Short Foundation Tubes with Soil Plates and Wood Post Inserts
Option 5	Long Foundation Tube with Wood Post Inserts or Short Foundation Tube with Soil Plates and Wood Post Inserts	6' SYTP or Short Foundation Tube with SYT Post Insert

For Post locations 3 and 4, alternates to 6' SYT Posts are:

- All Short Foundation Tubes with Wood Post Inserts
- All 6' Wood CRT Posts
- All Short Foundation Tubes with SYT Post Insert
- Any combination of above options, as accepted by the FHWA and dictated by the state or specifying agency

**ET-31™ Guardrail End Treatment
NCHRP Report 350 Test Level 2
System Length 28'-1 1/2" (8.57 m)**

For specific assembly, maintenance, or repair details refer to the state or specifying agency's standard drawings and/or Trinity Highway Products standard layout drawings.

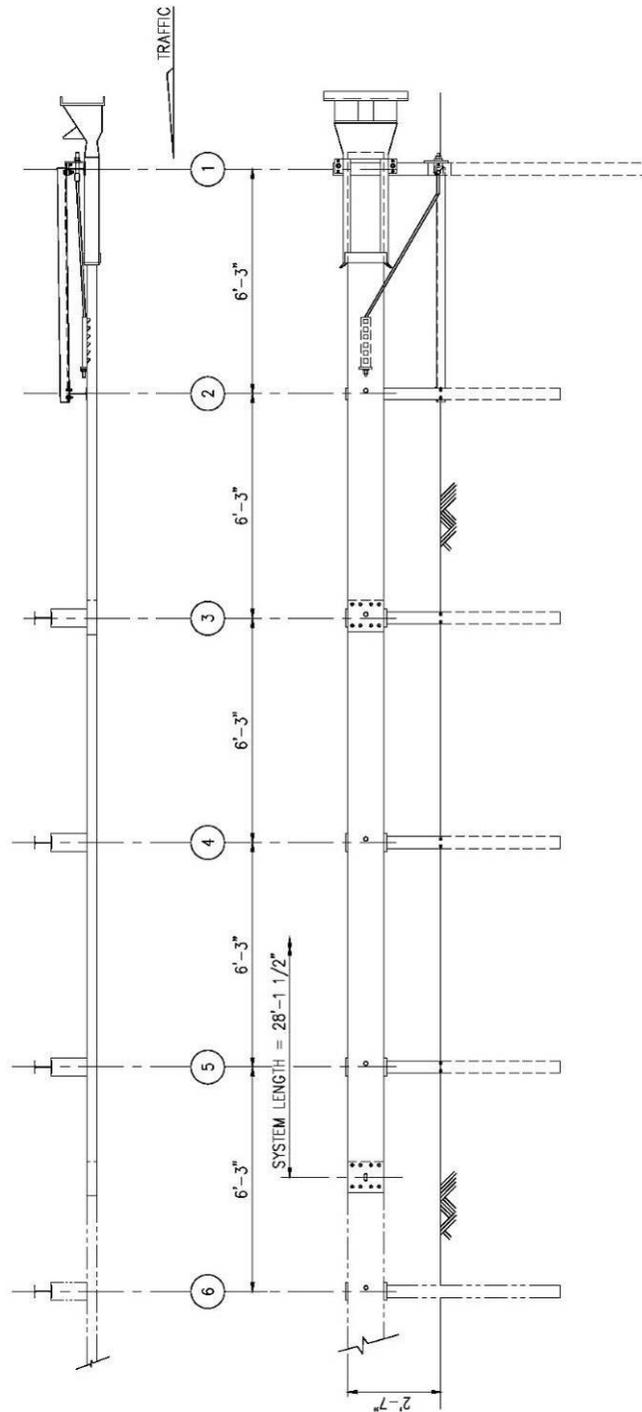


Figure 6 (TL-2)

[This drawing represents one version of the 28'-1 1/2" (8.57 m) system]

Alternative Post Combinations

At Post locations 1 and 2, the alternates to HBA Post at location 1 and 6' Steel Yielding Treatment Post (SYTP) at location 2 are:

	Post Location 1	Post Location 2
Option 1	HBA Post	Short Foundation Tube with SYT Post Insert
Option 2	Long Foundation Tube with Wood Post Insert	6' SYTP or short Foundation Tube with SYT Post Insert
Option 3	Long Foundation Tubes with Wood Post Inserts	Long Foundation Tubes with Wood Post Inserts
Option 4	Short Foundation Tubes with soil plates and Wood Post Inserts	Short Foundation Tubes with Soil Plates and Wood Post Inserts
Option 5	Long Foundation Tube with Wood Post Inserts or Short Foundation Tube with Soil Plates and Wood Post Inserts	6' SYTP or short Foundation Tube with SYT Post Insert

For Post locations 3 and 4, alternates to 6' SYT Posts are:

- All Short Foundation Tubes with Wood Post Inserts
- All 6' Wood CRT Posts
- All Short Foundation Tubes with SYT Post Insert
- Any combination of above options, as accepted by the FHWA and dictated by the state or specifying agency

For Post locations 5:

- Steel or Wood line Post dictated by the state or specifying agency

Bill of Materials English (Metric)



Warning: Use only Trinity Highway Products parts that are specified herein for the ET-31™ Guardrail End Treatment for assembling, maintaining, or repairing the ET-31™ Guardrail End Treatment. Do not utilize or otherwise comeingle parts from other systems even if those systems are other Trinity Highway Products systems. Such configurations have not been tested, nor have they been accepted for use. Assembly, maintenance, or repairs using unspecified parts or accessories is strictly prohibited. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact with an UNACCEPTED system.

ET-31™ Guardrail End Treatment

(For specific materials and quantities, see state or specifying agency's options and Trinity standard layout drawings)

PN	Description
11G	12/12.5'/3'-1.5"/S (2.67/3.81/0.952/S) (Guardrail)
32G	12/12.5'/6' 3"/S (2.67/3.81/1.905/S) ANC (Guardrail)
60G	12/25'/6' 3"/S (2.67/7.62/1.905/S) (Guardrail)
704A	Cable Anchor Bracket (unique to ET systems), with welded ears
705G	Pipe Sleeve - 2" STD Pipe x 51/2" (50 STD Pipe x 150 Pipe)
740G	6" x 8" x 4' 6" x 3/16 (152 x 203 x 1375 x 4.8) Tube Sleeve
749G	6" x 8" x 6' 0" x 3/16 (152 x 203 x 1830 x 4.8) Tube Sleeve (Alternate to using 740G and 766G)
758G	6" x 8" x 3'10"x 3/16" (252 x 203 x 1168 x 4.8) Tube Sleeve
766G	18" x 24" x 1/4" (460 x 610 x 16) Soil Plate
782G	8" x 8" x 5/8" (200 x 200 x 16) Bearing Plate (For Wood Post)
995A	ET-PLUS™ Extruder (Head)
3000G	Cable (Assembly) 3/4" x 6' 6" (19 x 1981)
3300G	5/8" (16) Round Washer
3340G	5/8" (16) HGR Nut
3391G	5/8" DIA. x 1 3/4" (16 DIA. x 45) Hex Head Bolt (High Strength)
3360G	5/8" DIA. X 1 1/4" (16 DIA. x 35) Splice Bolt (HGR)
3478G	5/8" DIA. x 7 1/2" (16 DIA. x 190) Hex Head Bolt
3497G	5/8" DIA. x 9 1/2" (16 DIA. x 240) Hex Head Bolt
3500G	5/8" DIA. x 10" (16 DIA. x 255) HGR Post Bolt
3580G	5/8" DIA. x 18" (16 DIA. x 460) HGR Post Bolt
3620G	5/8" DIA. x 22" (16 DIA. x 560) HGR Post Bolt
3700G	3/4" (19) Washer (F844)
3701G	3/4" (19) Washer (F436)
3704G	3/4" (19) Hex Nut
3717G	3/4" x 2 1/2" (19 x 75) Hex Head Bolt (High Strength)
3718G	3/4" x 3" (19 x 75) Hex Head Bolt (High Strength)
3900G	1" (25) Round Washer
3910G	1" (25) Hex Nut
4071B	Wood Post 6" x 8" x 6' 0" (150 x 200 x 1830) CRT

4075B	Wood Block 6" x 8" x 14" (150 x 200 x 355) DR
4076B	Wood Block 6" x 8" x 14" (150 x 200 x 355) DR Routed
4140B	Wood Post 5 1/2" x 7 1/2" x 4'-0 1/4" (140 x 190 x 1225)
4161B	HDPE spacer (SYTP™)
4228B	3/8" x 4" (10 x 100) Lag Screw
4254G	3/8" (10) Round Washer
4255G	3/8" (10) Fender Washer 1 1/2" OD (38)
4258G	3/8" (10) Lock Washer
4261G	3/8" DIA. X 1 1/2" (10 x 38) Hex Head Bolt (Grade 5)
4389G	7/16" (11) Round Washer
4390G	7/16" DIA. x 1 1/2" (11 x 38) GR. 5 Hex Head Bolt
4393G	7/16" (11) Lock Washer
4396G	7/16" (11) Hex Nut
4660B	Wood Block 6" x 12 3/8" x 14" (150 x 315 x 350) Routed
4699G	3/4" (19) Lock Washer
5148G	3/4" DIA. X 9 1/2" (19 DIA. x 240) Hex Head Bolt (High Strength)
5978B	Polymer Block 4 x 12 x 14 (100 x 305 x 350)
6120G	Wood Block 6" x 12" x 14" (150 x 305 x 350)
6321G	3/8" x 2' (10 x 50) Hex Head Bolt (Grade 5)
6405G	3/8" (10) Hex Nut
6907B	Polymer Block 4" x 7 1/2" x 14" (100 x 187 x 350) [King Block]
10967G	12/9'4.5/3'1.5/S (2.67/2.85/0.952/S) (Guardrail)
14328G	3' 9 7/8" Steel Yielding Treatment Post (SYTP™)
15000G	6' Steel Yielding Treatment Post™ (SYTP™)
19258A	8" x 8" x 5/8" (200 x 200 x 16) Bearing Plate With Two Ears/Tabs (For HBA Post)
19948G	1 3/4" x 10 GA x 1 3/4" (44 x 3 x 44) Plate Washer
20442G	12/15'7.5/3'1.5:2@6'3/S (2.67/4.76/.952:2@1.905/S) (Guardrail)
49398A	ET HBA™ Post #1 Top
33873A	ET HBA™ Post #1 Bottom
9852A	Strut (and Yoke Assembly)
32922G	6' 6" (1980) Angle Strut HBA™ / SYTP™ / Wood
33875G	6' 6" (1980) Angle Strut ET HBA™ (6'-3 C/C Slots)
33795G	6' 6" (1980) Angle Strut HBA™ / SYTP™
33730G	6' 7 1/2" (2020) Angle Strut SYTP™ / Wood
33847G	6' 9 1/8" (2060) Angle Strut SYTP™ / CRP

Delineation Options

PN	Description
6206B	Right Side 13" x 27 1/2" (325 x 700) Reflective Sheeting Amber
6207B	Left Side 13" x 27 1/2" (325 x 700) Reflective Sheeting Amber
6668B	Either Side 12" x 12" (305 x 305) Reflective Sheeting (Typically 2 required) Amber
3534B	Either Side 12" x 12" (305 x 305) Reflective Sheeting (Typically 2 required) Silver

Assembling the ET-31™ Guardrail End Treatment

Materials

As packaged, the NCHRP Report 350 ET-31™ Guardrail End Treatment includes all materials needed for a complete assembly. The pay limit will include a 34' 4.5" (10.48 m) system, 40' 7.5" (12.38 m) system, 46' 10.5" (14.29 m) system, or 53' 1.5" (16.19 m) system for TL-3 or 21' 10.5" (6.68 m) or 28' 1.5" (8.57 m) system for TL-2, unless otherwise specified in the contract plans.

Note: Concrete footings or foundations are not required.

Recommended Tools

- 9/16" (14 mm) Socket or wrench
- 15/16" (24 mm) Socket or wrench
- 1 1/4" (32 mm) Socket or wrench
- 1 1/2" (38 mm) Socket or wrench
- Augers
- Post pounders (commonly used in driving Posts)
- Locking pliers
- Tape measure

Recommend Tools for Repair

- Acetylene torch to cut off extruded rail
- Heavy-duty chain to remove the ET-PLUS™ Extruder (Head)
- Locking pliers or Channel Lock pliers
- Sledge hammer
- Post removal tool and other normal guardrail tools
- Eye bolts connected to heavy duty chain (to remove the Posts from Tubes)
- Vehicle to pull the Extruder (Head) from the damaged rail

Note: The above list(s) of tools is a general recommendation. Depending on specific site conditions and the complexity of the assembly specified by the appropriate highway authority, additional or fewer tools may be required. Decisions as to what tools are needed to perform the job are entirely within the discretion of the specifying highway authority, and the authority's selected contractor performing the assembly of the system at the authority's specified site. It is the province of the engineer working under the authority of the local highway authority that owns and has specified this product as to whether or not they wish to use the Extruder (Head) again after impact. Trinity makes no recommendation in this regard.

Site Preparation

When the Guardrail is placed in-line with edge of the shoulder (without any offset), a 25:1 or flatter straight flare over the length of the systems can be used to position the ET-PLUS™ Extruder (Head) further away from the edge of the shoulder. Site grading may be necessary for assemblies beyond the edge of the shoulder for the proper placement of the steel tubes and the CRT Posts. Use the state or specifying agency's standard specifications and drawings for the site grading. Trinity does not direct grading. Complete all grading before the start of the assembly of the ET-31™ Guardrail End Treatment. See *Assembly of the ET-31™ Guardrail End Treatment on a Curve* section for the layout of the ET-31™ Guardrail End Treatment on a curve on Page 24.

If the system is deployed on a curve, see *Assembly of the ET-31™ Guardrail End Treatment on a Curve* section on Page 24. When placing the ET-31™ Guardrail End Treatment outside or inside the curve, the ET-31™ Guardrail End Treatment must be straight over the length of the system. If there are special field conditions encountered when assembling the ET-31™ Guardrail End Treatment, contact the state or specifying agency's engineer. Trinity Highway Products LLC, at (888) 323-6374, is available for consultation with that agency.

Post Placed in Rigid Material

Provide the proper leaveout (the specified area of open space in the pavement) around a Post when assembling the Post in any thickness of concrete or asphalt. The top surfaces of any grout or other backfill placed in the rigid material leaveout **MUST be low enough** so that it does not restrict smooth release of the Anchor Cable Bearing Plate at Post 1 or otherwise obstruct or constrain the 3/8" shear bolts or the 3/4" hinge bolts of the HBA Post. The assembly shall not impede in any fashion the hinging-action or release mechanism of the No. 1 HBA post by burying it in rigid material (asphalt, concrete, rigid soil, etc.)

For leaveout information, please consult the applicable state or specifying agency. Additional source of leaveout information or details can be found in the U.S. Department of Transportation, Federal Highway Administration, Memorandum B 64-B, dated 3/10/04. Trinity can provide this FHWA memo upon request.

Assembling the ET-31™ Guardrail End Treatment on a Curve

When the ET-31™ Guardrail End Treatment is placed on a curve, use the following layouts. All offsets are measured to the face of the rail. Under no circumstances shall the guardrail within the ET-31™ Guardrail End Treatment pay limit be curved.

- Outside the curve: With the line guardrail placed parallel to the curve, the Treatment end is offset from the curve a distance equal to the line guardrail offset plus the value in Table 1. Consult state or specifying agency drawings for details.
- Inside the curve (radius greater than 1000 feet): With the line guardrail placed parallel to the curve, the Treatment end is offset from the curve a distance equal to the line guardrail offset plus the value in Table 1. Consult state or specifying agency drawings for details.
- Inside the curve (radius 1000 feet or less): With the line guardrail placed parallel to the curve, the Treatment end is offset from the curve a distance equal to the line guardrail offset plus one foot maximum in Table 1. Consult state or specifying agency drawings for details.

Table 1

ET-31™ Length	Outside the Curve Max Offset	Inside the Curve With a Radius Greater Than 1000 Feet Max Offset	Inside the Curve With a Radius 1000 Feet or Less Max Offset
53' 1.5"	24 Inches	24 Inches	12 Inches
46' 10.5"	18 Inches	18 Inches	12 Inches
40' 7.5"	18 Inches	18 Inches	12 Inches
34' 4.5"	12 Inches	12 Inches	12 Inches
28'-1 1/2"	12 Inches	12 Inches	12 Inches
21'-10 1/2"	12 Inches	12 Inches	9 Inches

Assembling the Posts

Complete the following steps when assembling HBA™ Posts, Steel Yielding Treatment Posts™ (SYTP™), foundation tube with wood Posts and wood CRT Posts. For non-breakaway posts, follow the agency's assembly instructions. For placing posts in rigid pavement, also see the Post Assembled in Rigid Material section.

Assembling HBA™ Post

Assembling HBA™ Bottom Post – Post Location 1

Complete the following steps to assemble the HBA™ Bottom Post:

Step	Actions
1.	Arrange the HBA™ bottom (PN-33873A) posts so that the large hole (13/16" [21 mm]) is placed downstream (away from the impact end of the system).
2.	Select Option A or Option B for this assembly.
Option A	Drive the HBA™ Bottom Post with an approved driving head to a depth of approximately 72" (1830 mm).
Option B	<ol style="list-style-type: none">1. Drill a 12" (300 mm) maximum diameter pilot hole approximately 72" (1830 mm) deep.2. Insert the bottom HBA™ Post in the hole.3. Backfill the holes with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction. <p>Note: In either option, the optimum depth will have the 13/16" (21 mm) hole in the post plates (ears/tabs) even with the finished grade.</p>

Assembling HBA™ Top Post

Complete the following steps to assemble the HBA™ Top Post, after the Bottom Post has been assembled:

Step	Actions
1.	Place the Top Post (PN-49398A) at Post 1, by aligning the holes of the post plates (ears) on the top and bottom posts. Note: The Top Post's post plates (ears) can be attached on either side of the Bottom Post's post plates (ears).
2.	Insert a 3/8" (10 mm) diameter x 2" (50 mm) hex head high strength bolt (PN-6321G) through the 7/16" (11 mm) holes of the post plates (ears) on the Top and Bottom Posts.
3.	Place a 3/8" (10 mm) washer (PN-4252G) and a 3/8" (10 mm) lock washer (PN-4258G) under a 3/8" (10 mm) hex nut (PN-6405G) on the inserted bolts to secure. Note: The bolts can be assembled so the nuts are on the inside or outside of the post plates (ears).
4.	Tighten the nuts to a snug position. The designer does not recommend a torque requirement for the HBA field assembly.
5.	Insert a 3/4" (19 mm) diameter x 2 1/2" (63 mm) hex head high strength bolt (PN-5148G) in the 13/16" (21 mm) hole of the HBA™ Post 1 post plates on the side opposite the strut. Do not assemble the 3/4" (19 mm) bolt on the strut side of Post 1, until the strut is ready to be assembled. Note: The bolts can be assembled so the nuts are on the inside or outside of the post plates (ears).
6.	Place a 3/4" (19 mm) washer (PN-3701G) and a 3/4" (19 mm) lock washer (PN-4699G) under a 3/4" (19 mm) hex nut on the inserted bolt to secure.
7.	Tighten the nuts to a snug position. The designer does not recommend a torque requirement for the HBA field assembly.

Assembling the Steel Yielding Treatment Post™ (SYTP™)

The SYTP™ can be driven or assembled in a tube. For SYTP™ assembly in a tube, see the *Assembling the SYTP™ in Tubes* section. The SYTP™ can be assembled at all locations EXCEPT at location 1. Complete the following step to assemble the SYTP™:



Warning: Do NOT assemble SYTP™ at location 1. Failure to follow this warning could result in serious injury or death in the event of a collision.

Placing the 6' (1.83 m) SYTP™

Step	Actions
1.	Drive all the 6' 0" SYTP™ (PN-15000G) to the optimum depth where the centers of the four yielding holes through the flange are at the ground line.
	Warning: DO NOT assemble SYTP™ at location 1. Failure to follow this warning could result in serious injury or death in the event of a collision.
	Warning: Ensure that the proper leaveout (the specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts assembled in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.

Assembling Foundation Tubes

Complete the following steps to assemble foundation tubes.

6' 0" Foundation Tube (Post locations 1 and/or 2)

Step	Actions
1.	Assemble a 5/8" x 7 1/2" (16 mm x 190 mm) hex head bolt (PN-3478G) and 5/8" (16 mm) HGR nut (PN-3340G) in the Foundation Tube (PN-749G) as a post stop. Use 2 bolts when the SYTP is assembled. Use 1 bolt when a Wood Post is assembled. Note: Do not over tighten the nuts and deform the tubes as this will complicate post replacement.
2.	The foundation tube can be assembled by driving or with a pilot hole. See <i>For Driven Foundation Tube Assembling</i> or <i>For Pilot Hole Foundation Tube Assembly</i> sections for assembly instructions.
3.	Assemble the foundation tubes at locations 1 and 2. Use the strut as a guide for the spacing of the tubes. Note: Do not drive Tubes with the Wood Post inserted; this will complicate post replacement.
	Warning: Ensure that the proper leaveout (the specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts assembled in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.

4' 6" Foundation Tube with Soil Plate (Post locations 1 and/or 2)

Step	Actions
1.	Bolt the Soil Plate (PN-766G) to the Foundation Tube (PN-740G) with two 5/8" x 7 1/2" (16 mm x 190 mm) hex head bolts (PN-3478G) and 5/8" (16 mm) HGR nuts (PN-3340G) (no washers). Note: Do not over tighten the nuts and deform the tubes; this will complicate post replacement.
2.	The foundation tube can be placed by driving or with a pilot hole. See <i>For Driven Foundation Tube Assembly</i> or <i>For Pilot Hole Foundation Tube Assembly</i> sections for assembly instructions.
3.	Assemble the foundation tubes at locations 1 and 2. Use the strut as a guide for the spacing of the tubes. If the Soil Plate is utilized, position it on the downstream side of the post (away from the Impact Head). Note: Do not drive Tubes with the Wood Post inserted; this will complicate post replacement.
	Warning: Ensure that the proper leaveout (the specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts assembled in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.

4' 6" Foundation Tube (Post locations 2 - 6, per state specifications):

Step	Actions
1.	Assemble a 5/8" x 7 1/2" (16 mm x 190 mm) hex head bolt (PN-3478G) and 5/8" (16 mm) HGR nut (PN-3340G) in the Foundation Tube (PN-749G) as a post stop. Use 2 bolts where the SYTP is placed. Use 1 bolt when a wood post is attached. Note: Do not over tighten the nuts and deform the tubes as this will complicate post replacement.
2.	The foundation tube can be assembled by driving or with a pilot hole. See <i>For Driven Foundation Tube Assembly</i> or <i>For Pilot Hole Foundation Tube Assembly</i> sections for Assembly instructions.
3.	Assemble the foundation tubes. Use the strut as a guide for the spacing of the tube at location 2. Note: Do not drive tubes with the wood post inserted; this will complicate post replacement.
	Warning: Ensure that the proper leaveout (the specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts placed in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.

3' 10" Foundation Tube (Post locations 2 - 6, per state specifications):

Step	Actions
1.	Assemble a 5/8" x 7 1/2" (16 mm x 190 mm) hex head bolt (PN-3478G) and 5/8" (16 mm) HGR nut (PN-3340G) in the Foundation Tube (PN-758G) as a post stop. Use 2 bolts where the SYTP is deployed. Use 1 bolt when a wood post is deployed. Note: Do not over tighten the nuts and deform the tubes as this will complicate post replacement.
2.	The foundation tube can be assembled by driving or with a pilot hole. See <i>For Driven Foundation Tube Assembly</i> or <i>For Pilot Hole Foundation Tube Assembly</i> sections for Assembly instructions.
3.	Assemble the foundation tubes. Use the strut as a guide for the spacing of the tube at location 2. Note: Do not drive Tubes with the Wood Post inserted; this will complicate post replacement.
	Warning: Ensure that the proper leaveout (the specified area of open space in the pavement) around the Posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts placed in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.

Assembly Options for Foundation Tubes

Complete the following steps to place foundation tubes.

For Driven Foundation Tube Assembly

Step	Actions
1.	Drive the foundation tubes (with an appropriate driving head) to the optimum depth, where the top of the tube is 2 5/8" (67 mm) above the finished grade. Note: Take extra care to prevent settlement or lateral displacement of the tubes, to ensure the posts attach to the guardrail, correctly.
2.	Ensure that the finished guardrail height will be approximately 31" (787 mm) above the finished grade, or as the state or specifying agency plans indicate.
3.	Ensure that the tubes do not project more than 4" (100 mm) above the finished grade.
	Warning: Ensure that the proper leaveout (the specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts placed in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.

For Pilot Hole Foundation Tube Assembly

Step	Actions
1.	Drill a 12" (300 mm) maximum diameter pilot hole approximately 49" (1245 mm) deep for the 3' 10" (1168 mm) long foundation tube, 57" (1450 mm) deep for the 4' 6" (1370 mm) long foundation tube or 75" (1905 mm) for the 6' 0" (1830 mm) long foundation tube. If the foundation tube has a soil plate, use Option A or B with this step.
Option A	Cut slots for the soil plates out by hand or by using a rock bar and then follow all of the steps of Option A for 4' 6" tube with soil plate, above.
Option B	Drill three adjacent 12" (300 mm) maximum diameter holes or one 24" (610 mm) maximum diameter hole to accommodate the soil plate / tube assembly and then follow all of the steps of Option A for 4' 6" tube with soil plate, above. Note: Take extra care to prevent settlement or lateral displacement of the tubes, to ensure the posts attach to the guardrail correctly.
	Warning: Ensure that the proper leaveout (specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts placed in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.
2.	Backfill the hole with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction.
3.	Ensure that the finished guardrail height will be approximately 31" (787 mm) above the finished grade, or as the state or specifying agency plans indicate.
4.	Ensure that the tubes do not project more than 4" (100 mm) above the finished grade.

Assembling the SYTP™ in Tubes (Post Locations 2 through 6)

Step	Actions
1.	Attach the 3' 9 7/8" (1.16 m) SYTP™ (PN-14328G) in tubes.
	Warning: DO NOT assemble SYTP™ at location 1. Failure to follow this warning could result in serious injury or death in the event of a collision.
	Warning: Ensure that the proper leave out (the specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts assembled in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.
2.	Follow the instructions in the <i>Assembling the Strut</i> section, Step 5.
3.	Except at Post 1, assemble the SYTP™ in a tube at locations required for the system with the four yielding holes (through the flange) at the top of the tube.
4.	From the embankment side of the tube, insert a 5/8" x 9 1/2" (16 mm x 240 mm) hex head bolt (PN-3497G) through the tube, the spacer (PN-4161), and the SYTP™
5.	Place a 5/8" (16 mm) HGR nut (PN-3340G) on the inserted bolt, to secure the SYTP™ to the tube. Note: Do not over tighten the nut and deform the tubes; this will complicate post replacement.

Assembling Wood Posts in Tubes

Complete the following steps to assemble wood posts in tubes:

Step	Actions
1.	Insert Pipe Sleeve (PN-705G) in post (PN-4140B) and assemble the wood post in the steel tube at location 1.
2.	Assemble Wood Post(s) (PN-4140B) in tubes at locations required for the system, as dictated by the state or specifying agency.
3.	Insert a 5/8" x 9 1/2" (16 mm x 240 mm) hex head bolt (PN-3497G) through the Foundation Tube and the Wood Post at all locations EXCEPT locations 1 and 2. Note: The bolt must be assembled from the embankment side, to aid in possible post replacement.
4.	Place a 5/8" (16 mm) HGR nut (PN-3340G) on the end of the inserted bolt.
5.	Tighten the nuts to a snug position. Note: Do not over tighten the bolts and deform the tubes; this will complicate post replacement.
	Warning: Ensure that the proper leaveout (the specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts assembled in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.

Assembling Wood CRT Posts

Complete the following steps to assemble the wood CRT posts:

Step	Actions
1.	Assemble the Wood Posts (PN-4071B) at locations required for the system, spaced at 6' 3" (1270 mm) apart. Select Option A or Option B to place the CRT posts.
Option A	Drive posts into the ground.
Option B	<ol style="list-style-type: none"> 1. Drill 12" (300 mm) maximum diameter pilot holes approximately 44" (1120 mm) deep. 2. Insert the 6' 0" (1830 mm) Wood Posts into these holes. 3. Backfill the holes with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction.
	Note: In either option within Step 1, the bottom of the upper 3 1/2" (90 mm) hole in the post is approximately at the finished grade.
	Warning: DO NOT assemble 6' 0" CRT post at location 1 and 2. Failure to follow this warning could result in serious injury or death in the event of a collision.
	Warning: Ensure that the proper leaveout (the specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts assembled in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.

Assembling Foundation Tubes, HBA™ Posts, or SYTP™ when Encountering Rock

Complete the following steps to assemble foundation tubes, HBA™ posts or SYTP™ when encountering rock:

Step	Actions
1	Select Option A or Option B below when encountering rock, unless there is a more restrictive state or specifying agency specification.
Option A	If rock is encountered and 20 inches (510 mm) or less of the full length post or foundation tube remains to be embedded:
	<ol style="list-style-type: none"> 1. Drill a 12" to 16" (300 mm to 400 mm) diameter hole into the rock. 2. Drill holes 2" (50 mm) deeper than the required embedment depth. 3. Place granular material or small pieces of the drilled rock in the bottom 2" (50 mm) of the hole for drainage. 4. Assemble the tube or post into the hole. Backfill the hole with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction.
	Note: If compactable, the material removed from the hole may be used for backfill.

Option B	<p>If rock is encountered and more than 20 inches (510) of the full length post or foundation tube remains to be embedded:</p> <ol style="list-style-type: none"> 1. Drill a 12" to 16" (300 mm to 400 mm) diameter hole 22" (560 mm) deep into the rock. 2. Cut off the embedded portion of the tube or post so the Guardrail will be at the proper mounting height. Cutting off the bottom of the embedded portion of full length post or foundation tube is permitted only when a minimum of 20" (510 mm) embedment into rock can be achieved. 3. Place granular material or small pieces of the drilled rock in the bottom 2" (50 mm) of the hole for drainage. 4. Assemble the tube or post in the hole. Backfill the hole with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction. <p>Note: If compactable, the material removed from the hole may be used for backfill.</p>
	<p>Warning: Ensure that the proper leaveout (the specified area of open space in the pavement) around the posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement, for any posts assembled in rigid pavement such as any thickness of concrete or asphalt. Failure to follow this warning could result in serious injury or death in the event of a collision.</p>

Assembling the Strut

Complete the following steps when assembling the strut:

Note: For all strut assemblies, the assembler must provide a shallow valley or trough for assembly of the strut, since a portion of the angle strut will be below grade.

Assembling the Strut with HBA™ Post at Post 1 and SYTP™ at Post 2

Complete the following steps to assemble the strut.

At Post 1

Step	Actions
1.	<p>Place the angle strut on the outside flanges of the HBA™ post.</p> <p>Note: The strut can be placed with one of the legs flat on the ground or with the leg edge on the ground. The strut may be attached either on the traffic side or the field side of the posts.</p>
2.	<p>Assemble a 3/4" (19 mm) diameter x 2 1/2" (63 mm) hex head high strength bolt (PN-3717G) in the 13/16" (21 mm) hole of the HBA™ Post 1 post plates. Place the bolt through the top and bottom post's post plates and through the strut.</p>
3.	<p>Place a 3/4" (19 mm) washer (PN-3700G) and a 3/4" (19 mm) lock washer under a 3/4" (19 mm) hex nut on the end of the bolt to secure.</p>
4.	<p>Tighten the nuts to a snug position. (The designer does not recommend a torque requirement.)</p>

For Angle Strut with 6' SYTP™ at Post 2

Step	Actions
1.	Place the Angle Strut (PN-33795G) on the embankment side of the SYTP™. (The strut can be placed with one of the legs flat on the ground or with the leg edge on the ground.)
2.	Place a 7/16" (11 mm) round washer (PN-4389G) on the two 7/16" (11 mm) diameter x 1 1/2" (38 mm) hex head high strength bolts (PN-4390G).
3.	Insert the two bolts through the two slotted holes of the strut and the yielding diameter holes of the SYTP™, at Post 2.
4.	Place a 7/16" (11 mm) lock washer (PN-4393G) and a plate washer (PN-19948G) under a 7/16" (11 mm) hex nut (PN-4388G) on the ends of inserted bolts. When in the correct position, plate washer is placed against yielding holes of the post and under the lock washer and nut.
5.	Tighten the nuts to a snug position. (The designer does not recommend a torque requirement.)

For Angle Strut with SYTP™ in Tube at Post 2

Step	Actions
1.	Place the Angle Strut (PN-33875G) on the embankment side of the tube. (The strut can be placed with one of the legs flat on the ground or with the leg edge on the ground.)
2.	Place a 3/4" (19 mm) washer (PN-3701G) on a 3/4" (19 mm) diameter x 9 1/2" (240 mm) hex head high strength bolt (PN-5148G).
3.	From the embankment side, insert the bolt through the Strut, Foundation Tube, spacer (PN-4161), and the SYTP™ at Post 2.
4.	Place a 3/4" (19 mm) washer (PN-3701G) under a 3/4" (19 mm) hex nut on the end of the inserted bolt.
5.	Tighten the nuts to a snug position. (The designer does not recommend a torque requirement.) Note: Do not over tighten the bolts and deform the tubes; this will complicate possible post replacement.

Assembling the Strut with Wood CRT Post in Tube at Post 1 and SYTP™ at Post 2

Complete the following steps to assemble the strut:

At Post 1

Step	Actions
1.	Place the Angle Strut on the embankment side of the Foundation Tube.
2.	Place a 3/4" (19 mm) washer (PN-3701G) on a 3/4" (19 mm) diameter x 9 1/2" (240 mm) hex head high strength bolt (PN-5148G).
3.	From the embankment side, insert the bolt through the Strut, the Foundation Tube, and the Wood Post.
4.	Place a second washer under a 3/4" (19 mm) hex nut (PN-3704G) on the end of the inserted bolt.
5.	Tighten the nuts to a snug position. (The designer does not recommend a torque requirement.)

For Angle Strut with 6' SYTP™ at Post 2

Step	Actions
1.	Place the Angle Strut (PN-33730G) on the embankment side of the SYTP™. (The Strut can be placed with one of the legs flat on the ground or with the leg edge on the ground.)
2.	Place a 7/16" (11 mm) round washer (PN-4389G) on the two 7/16" (11 mm) diameter x 1 1/2" (38 mm) hex head high strength bolts (PN-4390G).
3.	Insert the two bolts through the two slotted holes of the strut and the yielding diameter holes of the SYTP™, at Post 2.
4.	Place a 7/16" (11 mm) lock washer (PN-4393G) and a plate washer (PN-19948G) under a 7/16" (11 mm) hex nut (PN-4388G) on the ends of inserted bolts. When in the correct position, the plate washer is assembled against the yielding holes of the post and under the lock washer and nut.
5.	Tighten the nuts to a snug position. (The designer does not recommend a torque requirement)

For Angle Strut with SYTP™ in Tube at Post 2

Step	Actions
1.	Place the Angle Strut (PN-33875G) on the embankment side of the tube. (The Strut can be placed with one of the legs flat on the ground or with the leg edge on the ground.)
2.	Place a 3/4" (19 mm) washer (PN-3701G) on a 3/4" (19 mm) diameter x 9 1/2" (240 mm) hex head high strength bolt (PN-5148G).
3.	From the embankment side, insert the bolt through the Strut, Foundation Tube, spacer (PN-4161), and the SYTP™ at Post 2.
4.	Place a 3/4" (19 mm) washer (PN-3701G) under a 3/4" (19 mm) hex nut on the end of the inserted bolt
5.	Tighten the nuts to a snug position. (The designer does not recommend a torque requirement.) Note: Do not over tighten the bolts and deform the tubes; this will complicate possible post replacement

Assembling the Strut with Wood Posts in Soil Tubes (Post Locations 1 and 2)

Complete the following steps to assemble the strut:

For Angle Strut

Step	Actions
1.	Place the Angle Strut (PN-33875G) on the embankment side of the Foundation Tubes.
2.	Place a 3/4" (19 mm) washer (PN-3701G) on a 3/4" (19 mm) diameter x 9 1/2" (240 mm) hex head high strength bolt (PN-5148G).
3.	From the embankment side, insert the bolt through the Strut, the Foundation Tube, and the Wood Post.
4.	Place a second washer under a 3/4" (19 mm) hex nut (PN-3704G) on the end of the inserted bolt.
5.	Tighten the nuts to a snug position. (The designer does not recommend a torque requirement.)

For Channel Ground Strut

Step	Actions
1.	Place the slotted yokes of the Ground Strut (PN-9852A) over the Foundation Tubes.
2.	Place a 5/8" (16 mm) round washer (PN-3300G) on a 5/8" (16 mm) diameter x 9 1/2" (240 mm) hex head bolt (PN-3497G).
3.	From the embankment side, insert the bolt through the Strut, Foundation Tube, and the Wood Post.
4.	Place a second washer under a 5/8" (16 mm) HGR hex nut on the end of the inserted bolt.
5.	Tighten the nuts to a snug position. (The designer does not recommend a torque requirement.) Note: Do not over tighten the bolts and deform the tubes; this will complicate possible post replacement.

Assembling Offset Blocks and Rail Panels

The ET-31™ Guardrail End Treatment uses a 12' 6" (3.81 m) Rail Panel (PN-32G). Depending on the state or specifying agency standards, a combination of the following Rail Panels will be used for their system: 9' 4 1/2" (2.86 m) Rail Panel (PN-10967G), 15' 7 1/2" (4.76 m) Rail Panel (PN-20442G), 12' 6" (3.81 m) Rail Panel (PN-11G), or 25' (7.62 m) Rail Panel (PN-60G).



Warning: DO NOT bolt the Rail Panel to the post at location 1 in any of the ET-31™ Guardrail End Treatment. Failure to follow this warning could result in serious injury or death in the event of a collision.

Splicing the Rail Panels

Complete the following steps to splice the rail panels:

Step	Actions
1.	Lap the Treatment rail in the direction of traffic, unless the state or specifying agency's policy dictates otherwise. EACH RAIL PANEL MUST BE STRAIGHT WITH NO VISIBLE DISTORTIONS OR BLEMISHES SUCH AS CURVES, DENTS, CUTS, TEARS, EXTRA HOLES, CUT-OUTS, CORROSION OR SIGNS OF PAST REPAIRS. Rails with distortions that could compromise its ability to resist compressive load induced by the Head during head-on impacts shall not be used.
2.	Splice the Rail Panels together with eight 5/8" x 1 1/4" (16 mm x 32 mm), HGR splice bolts (PN-3360G), and 5/8" (16 mm) HGR hex nuts.
	Warning: USE ONLY PROPER LENGTH SPLICE BOLTS (1-1/4" LONG) which have Trinity's "TRN" identifying mark stamped into the top of the bolt head. Failure to follow this warning could result in serious injury or death in the event of a collision.
3.	Tighten the bolts. (There is no torque requirement.)

Assembling the Offset Block and Rail Panel to Wood Posts (Posts 3 through 6)

Complete the following steps to attach the Offset Blocks and Rail Panels to the Wood Posts:

Step	Actions
1.	1. At locations with Wood Posts and Wood Blocks, insert a 5/8" (16 mm) diameter 22" (560 mm) HGR post bolt (PN-3620G) through the Rail Panel, Offset Block (PN-4660B), and the Post. Note: Offset Blocks are NOT used at post locations 1 and 2, but are used at all other locations.
	Warning: Do NOT bolt the Rail Panel to the post at location 1 in any of the ET-31™ Guardrail End Treatment. Failure to follow this warning could result in serious injury or death in the event of a collision.
2.	Place a 5/8" (16 mm) round washer (PN-3300G) under a 5/8" (16 mm) HGR nut (PN-3340G).
3.	Tighten the bolts. (There is no torque requirement for these bolts.)
4.	Secure the Offset Block by toe nailing the Block to the Post or the Post to the Block, with two 16d hot-dipped galvanized nails approximately 3" (75 mm) from the top of the Post or Block, one on each side, to prevent it from rotating.

Assembling the Offset Block and Rail Panel to SYTP™ (Posts 3 through 6)

Complete the following steps to attach the Offset Blocks and Rail Panels to the SYTP™:

Step	Actions
1.	At locations with Steel Yielding Treatment Post™ (SYTP™) with Offset Blocks, insert a 5/8" (16 mm) diameter x 14" (355 mm) HGR post bolt (PN-3540G) through the Rail Panel, routed Wood (PN-4076B) or Composite (PN-6707B) Blockout, and the SYTP™. Note: Offset Blocks are NOT used at post locations 1 and 2. For SYTP™ Inserts, there are two sets of holes in the SYTP™ for attaching the rail. Use the holes in the SYTP™ that will place the rail at the correct height.
	Warning: DO NOT bolt the Rail Panel to the post at location 1 in any of the ET-PLUS™ systems. Failure to follow this warning could result in serious injury or death in the event of a collision.

	Warning: Ensure all Wood Blocks or Composite Blocks used with steel posts are routed. Failure to follow this warning could result in serious injury or death in the event of a collision.
2.	Place a 5/8" (16 mm) round washer (PN-3300G) under a 5/8" (16 mm) HGR nut (PN-3340G) on the inserted bolt.
3.	Tighten the bolts. (There is no torque requirement for these bolts.)

Assembling the Rail Panel to the Post without Offset Block at Post 2

Complete the following steps to attach the Rail Panel to the Post without Offset Block at Post 2:

Step	Actions
1.	Select Option A or Option B to attach the Rail Panel without Offset Block at Post 2:
Option A	<p>For Wood Post:</p> <ol style="list-style-type: none"> 1. Insert a 5/8" (16 mm) diameter x 10" (255 mm) HGR post bolt (PN-3500G) through the Rail Panel and the Wood Post at location 2. 2. Place a 5/8" (16 mm) round washer (PN-3300G) under a 5/8" (16 mm) HGR nut (PN-3340G) on the inserted bolt. Tighten the bolts. (There is no torque requirement for these bolts.)
Option B	<p>For SYTP™:</p> <ol style="list-style-type: none"> 1. Insert a 5/8" (16 mm) diameter x 1 1/4" (31 mm) HGR bolt (PN-3360G) through the Rail Panel and the hole in the SYTP™. <p>Note: For SYTP™ Inserts use the hole in the SYTP™ that will place the Rail Panel at the correct height. (If there are two sets of holes in the SYTP™ for attaching the Rail Panel.)</p> <ol style="list-style-type: none"> 2. Place a 5/8" (16 mm) round washer (PN-3300G) under a 5/8" (16 mm) HGR nut (PN- 3340G) on the inserted bolt.

Assembling the Cable Anchor Assembly

The Cable Anchor Bracket (PN-704A) is secured to the Rail Panel, by inserting the square protruding hooks / lugs on the bracket into the square slots in the rail panel. The Cable Anchor Bracket is locked into place, by pulling the bracket towards the impact end of the unit, making sure the hooks / lugs are well seated into the square holes.

Complete the following steps to assemble the Cable Anchor Bracket assembly:

Step	Actions
1.	Slide one end of the Cable (PN-3000G) into the Cable Anchor Bracket and the other end through Post 1.
2.	Place a 1" (25 mm) washer (PN-3900G) and 1" (25 mm) hex nut (PN-3910G) on the end of the cable that extends through the Cable Anchor Bracket. Turn the nut, until at least 2 threads are completely through the nut.
3.	Place the Bearing Plate (PN-19258A with two side ears/tabs on the steel post, PN-782G with no side ears/tabs on Wood Post) on the impact side of Post 1 where the Cable extends through the Post. The Cable Bearing Plate MUST BE oriented with the "long" dimension turned up. The hole in the Bearing Plate is off center (in the vertical direction), 5" (125 mm) from one edge and 3" (75 mm) from the opposite edge. The two ears/tabs on the Bearing Plate (PN-19258A) must straddle the left and right side of the HBA hinge assembly.
4.	If applying the Bearing Plate with no side ears/tabs (PN-782G) to a wood post at Post 1, drive two 16d hot-dipped galvanized nails along the top edge of the bearing plate and bend over to prevent the bearing plate from rotating.
	Warning: Any grout, backfill, or other materials (such as concrete, asphalt, or soil) must be low enough so as not to obstruct, constrain, or otherwise engage the Bearing Plate. Failure to eliminate the interaction of soil or materials with the Bearing Plate will hinder the performance of the ET-31™ Guardrail End Treatment and could result in serious injury or death in the event of a collision.
5.	Place a 1" (25 mm) washer under a nut on the end of the Cable extending through Post 1.
6.	Restrain the Cable with locking pliers at the end being tightened, to avoid twisting the Cable.
7.	Tighten the hex nuts on the Cable ends, until the Cable is taut. The Cable is considered taut when it does not deflect more than 1" (25 mm) when pressure is applied by hand in an up or down direction.
8.	The shank portion of the Anchor Cable MUST BE positioned so it bears on the bottom edge of the web of the HBA post. The shank portion of the Anchor Cable must also be centered so that the Bearing Plate bears uniformly on both flanges of Post 1.

Assembling the ET-PLUS™ Extruder (Head)

Complete the following steps to assemble the ET-PLUS™ Extruder (Head):

Step	Actions
1.	Place the ET-PLUS™ Extruder (Head) (PN-995A) over the end of the Rail Panel as the final piece to attach to the assembly. Note: The ET-PLUS™ Extruder (Head) can be used on the left or right hand shoulder.
2.	Push the ET-PLUS™ Extruder (Head) as far as it will go onto the front-most Rail Panel, making sure the Rail Panel is fully engaged into the full length of the channel guide attached to the Head until it stops.
3.	Assemble the ET-PLUS™ Extruder (Head) with channel guide attached to it approximately parallel to the ground. The upper and lower attachment tabs welded to the guide chute have three holes in each to provide a means to level the Head (See following steps).
4.	Select Option A or Option B for the ET-PLUS™ Extruder (Head) assembly.
Option A	For Wood post: 1. Place the ET-PLUS™ Extruder (Head) against the Wood Post, at location 1. 2. Choose the hole in the tab welded to the guide chute that is closest to the center of the Post. 3. Drill a 1/4" (6 mm) pilot hole to avoid breaking the lag screw during assembly. 4. Screw one 3/8" (10 mm) diameter x 4" (100 mm) lag screw (PN-4228B) through the top and bottom tab. The lag screw must be screwed into the Wood Post to prevent it from pulling out or cracking the post. DO NOT OVER TIGHTEN , causing the threads in the Wood Post to strip.
Option B	For HBA™ post: 1. Place the ET-PLUS™ Extruder (Head) against the HBA™ post, at location 1. 2. Place a 3/8" (10 mm) round washer (PN-4254G) onto a 3/8" (10 mm) diameter x 1 1/2" (38 mm) hex head bolt (PN-4261G). 3. Insert this bolt through the tab welded to the side of the guide channel attached to the ET-PLUS™ Extruder (Head) and then through the hole in the flange of HBA™ Post. 4. Place a 3/8" (10 mm) fender washer (PN-4255G) under a 3/8" (10 mm) nut (PN-6405G) onto the inserted bolt. A larger fender washer is used to cover the relatively large hole in the flange of the HBA Post. 5. Repeat this assembly step for the top and bottom tabs. When completed, the Head will be attached to the HBA post via an upper and lower 3/8" diameter hex head bolt (PN-4261G). 6. Tighten the nuts to a snug position. The designer does not recommend a torque requirement for the HBA field assembly.

Delineation Option for the ET-31™ Guardrail End Treatment

Apply High Intensity Reflective Sheeting (PN-6206B [Right Side] or PN-6207B [Left Side]) on the front face of the ET-PLUS™ Extruder (Head), per the state or specifying agency's *Manual on Uniform Traffic Control Devices* (MUTCD) for options or proper delineation. Alternate Reflective Sheeting is PN-6668B. The Alternate Reflective Sheeting requires two pieces and may be rotated for proper right or left delineation.

Note: The Reflective Sheeting is an option to the ET-31™ Guardrail End Treatment and needs to be ordered separate from the ET-31™ Guardrail End Treatment package.

Assembly Checklist

State: _____ Project: _____

Date: _____ Location: _____

- The leaveout (the specified area of open space in the pavement) around the Posts is reserved and filled with state or specifying agency approved backfill material that will not prevent movement for any posts placed in rigid pavement such as any thickness of concrete or asphalt.
- The finished guardrail height is approximately 31" (787 mm) above the finished grade, or as the state or specifying agency plans indicate.
- Any site grading needed was completed, before the start of the assembly of the ET-31™ Guardrail End Treatment.
- The Steel Tubes or Post Plates (ears) to the HBA™ bottom post do not protrude more than 4" (100 mm) above the finished grade measured by the American Association of State Highway and Transportation Officials (AASHTO) 5' (1.5 m) cord method. Site grading may be necessary to meet this requirement.
- The 3/4" (19 mm) bolts connecting the tops of the HBA™ Bottom Post to the bottom of the HBA™ Top Post are tightened to a snug position. The designer does not recommend a torque requirement for the HBA field assembly.
- The 3/8" (10 mm) bolts connecting the tops of the HBA™ Bottom Post to the bottom of the HBA™ Top Post are tightened to a snug position. The designer does not recommend a torque requirement for the HBA field assembly.
- The bolts at the top of the Steel Tubes are not over tightened. The walls of the Steel Tubes are not collapsed.
- If an Angle Strut was utilized, the bolts connecting the Angle Strut are 3/4" (19 mm) DIA. high strength.
- The ET-PLUS™ Extruder (Head) is pushed as far as it will go on the Rail Panel, ensuring the Rail Panel is fully engage into the channel guide that is welded to the Extruder (Head).
- The two 3/8" diameter bolts holding the ET-PLUS™ Extruder (Head) to Post 1 are snug and the channel guide welded to the Head is approximately parallel to the finished grade.
- The Cable Anchor Bracket is locked into place, by pulling the Bracket towards the impact end of the unit, making sure the hooks / lugs are well seated into the square holes.
- The shank portion of the Anchor Cable MUST BE positioned vertically flush against the bottom web of the top section of the HBA Post. The shank portion of the Cable MUST also be centered so that the Bearing Plate bears uniformly on both flanges of Post 1.
- Any grout, backfill, or other materials (such as concrete, asphalt, or soil) must be low enough so as not to obstruct, constrain, or otherwise engage the Bearing Plate.

- The hex nuts on the Cable ends are tightened, until the Cable is taut. The Cable is considered taut, when it does not deflect more than 1" (25 mm) when pressure is applied by hand in an up or down direction.
- Do not place anything under the rail to post bolt head that would prevent the bolt from pulling through the Rail Panel.
- The Bearing Plate is placed on the front of Post 1 where the Cable extends through the Post. The Cable Bearing Plate MUST BE oriented with the "long" dimension turned up. The hole in the Bearing Plate is off center (in the vertical direction), 5" (125 mm) from one edge and 3" (75 mm) from the opposite edge. If the Bearing Plate has two "ears/tabs", these need to straddle the left and right side of the No. 1 Post and be on the upper side of the plate.
- The top surfaces of any grout or other backfill placed in the mow strip "leave out" must be low enough so that it does not engage the Bearing Plate or otherwise obstruct or constrain the 3/8" (10 mm) shear bolts or the 3/4" (19 mm) hinge bolts of the HBA Post
- Any Wood Offset Blocks used have been toe nailed to the Wood Posts.
- If backfilled, make sure the backfill material around the Posts is properly compacted.
- Each HBA™ Post has two bolts on either side of the Post with the larger bolt downstream of the smaller bolt (away from the Impact Head).
- The SYTP™ holes are at the finished grade.
- The Wood CRT Post has two 3 1/2" (90 mm) breakaway holes (checked prior to assembly). They are located parallel to the roadway with the top hole located approximately at the finished grade.
- The tube bolts are attached with the nuts on the pavement side of the Tube for ease of future removal.
- The Rail Panels are lapped correctly and not attached to the Posts at locations identified for the system.
- Each Rail Panel used in the ET-31™ pay length is straight, with no visible distortions or blemishes such as curves, dents, cuts, tears, extra holes, cut-outs, corrosion, or signs of past repairs.
- The Reflective Sheeting is correctly positioned on the Extruder face.
- Ensure that this assembly conforms with the guidance provided by the *AASHTO Roadside Design Guide*, including, but not limited to, those regarding placement on curbs.

Maintenance and Repair

Always keep the Manual in a location where it is easily accessed by persons who assemble, maintain, or repair the ET-31™ Guardrail End Treatment. If you have any questions concerning the information in this Manual or about the ET-31™ Guardrail End Treatment, contact Trinity Highway Products at 888-323-6374.

Maintenance

Complete the following steps, periodically, to check the safety of the system:

Step	Actions
1.	Ensure the nuts have not been removed from the Cable. Replace nuts, if needed.
2.	Ensure the end fitting on the Anchor Cable MUST BE positioned vertically, up flush against the bottom web of the top section of the Post. The end fitting of the Cable MUST be centered horizontally so that the Bearing Plate bears uniformly on both flanges of Post 1.
3.	Ensure the Cable is taut. The Cable is considered taut when it does not deflect more than 1 inch when pressure is applied by hand in an up or down direction. Tighten Cable if needed.
4.	Ensure the Bearing Plate has not rotated. Note: The Cable Bearing Plate MUST BE oriented with the “long” dimension turned up. The hole in the Bearing Plate is off center (in the vertical direction), 5” (125 mm) from one edge and 3” (75 mm) from the opposite edge.
5.	Ensure Wood Blocks are in place and in good condition, as defined by the state or specifying agency.
6.	Ensure the Block Outs have not rotated. Correct the Block Out position and reattach the 16d hot-dipped galvanized nails, if needed.

Repair

Complete the following steps to repair the ET-31™ Guardrail End Treatment:

Step	Actions
1.	Set up necessary traffic control at the accident site and then remove any debris that has encroached onto the traveled way or shoulder.
2.	Take inventory of the damaged system and determine what parts are reusable, as defined by the state or specifying agency and what parts need to be replaced.
3.	Check the ET-PLUS™ Extruder (Head) for damage. The determination as to whether or not the Head is reusable rests entirely within the discretion of the DOT or other appropriate highway authority. Before reusing a Head, please make sure that an experienced, trained engineer for the highway authority inspects the Head to his or her satisfaction and authorizes its reuse. For consideration of reuse of the Extruder Head, the rail guide chute must be fully intact and not distorted in any way; the slot that flattens the rail shall not be excessively distorted in any way; the slot that flattens the rail shall not be excessively distorted; the front impact face must not be excessively distorted, and all the original welds must be intact. Again before reusing a Head, a trained DOT or applicable highway authority engineer shall inspect it and authorize its reuse.
4.	Check the Anchor Cable and Cable Anchor Bracket for damage. (The Bearing Plate, nuts, washers, and Cable Anchor Bracket are rarely damaged.)
5.	Obtain the Trinity Highway Products parts that need to be replaced from Trinity Highway Products. (See <i>Tools Required</i> section for a list of recommended tools for the repair of the ET-31™ Guardrail End Treatment.)

6.	Return to the repair site with the replacement parts and tools needed.
7.	Cut off the extruded rail near the ET-PLUS™ Extruder (Head). Do not cut the ET-PLUS™ Extruder (Head) from the non-extruded rail.
8.	Secure a chain to the ET-PLUS™ Extruder (Head).
9.	Attach the chain to a truck frame while the other end of the Rail Panel is still connected to the downstream Posts (away from the Impact Head) to provide anchorage.
10.	Pull the ET-PLUS™ Extruder (Head) off the Rail Panel.
11.	Remove any damaged Rail Panel(s).
12.	Remove the broken Posts from the Steel Tubes.
13.	Remove all damaged CRT, SYTP™, or HBA™ Posts. Undamaged HBA™ Posts can be reset.
14.	Remove and discard any rubber bumpers or construction legs.
15.	Reconstruct the system following the assembly instructions after the site has been cleared of damaged debris.
16.	Attach proper delineation for the repaired system in accordance with the state or specifying agency's <i>Manual on Uniform Traffic Control Devices</i> (MUTCD).

Notes:



2525 Stemmons Freeway

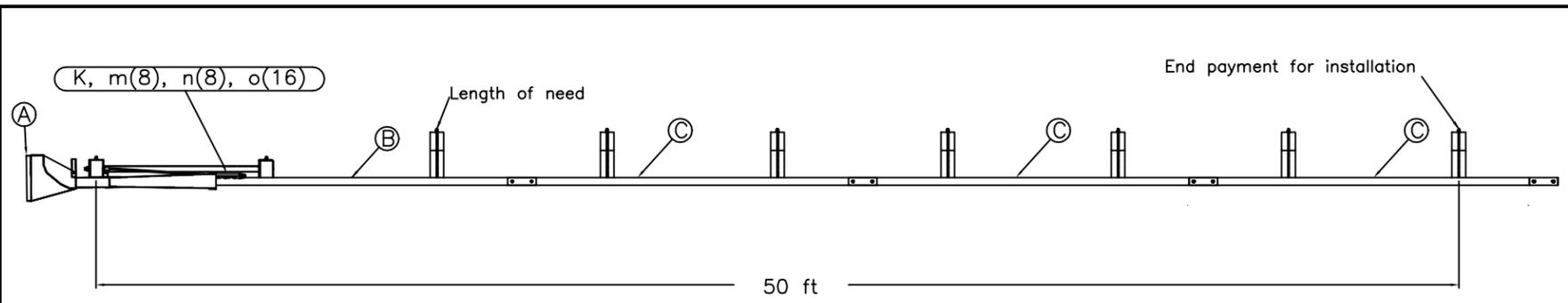
Dallas, Texas 75207

888-323-6374 (USA only)

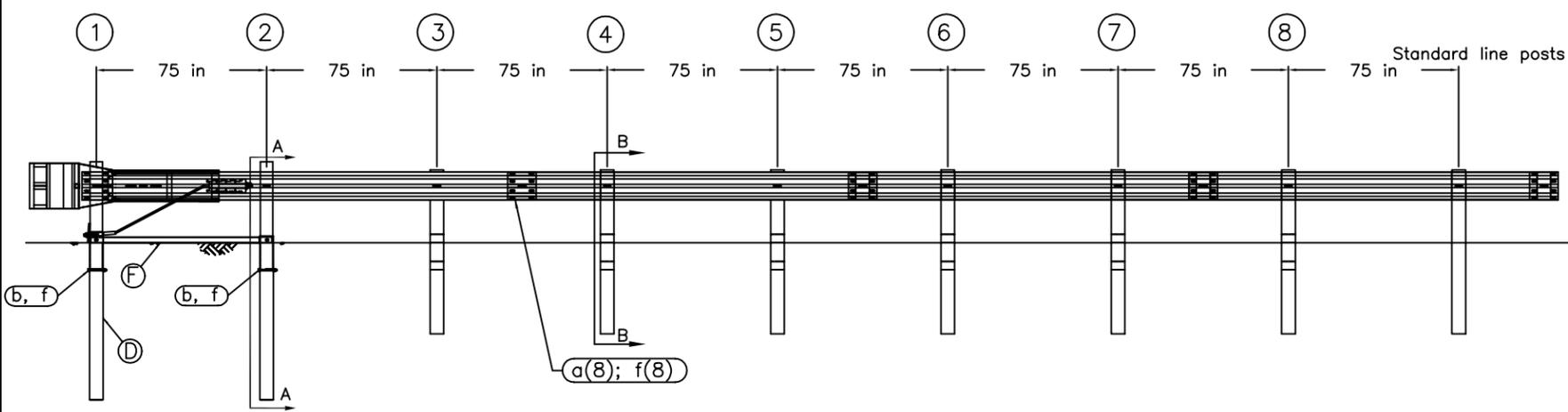
214-589-8140 (Outside USA)

www.energyabsorption.com

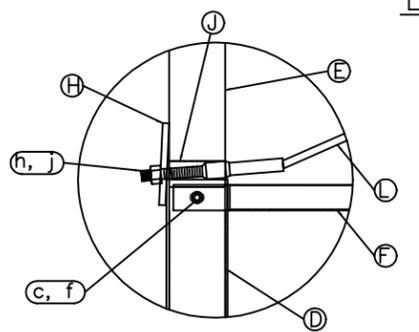
www.highwayguardrail.com



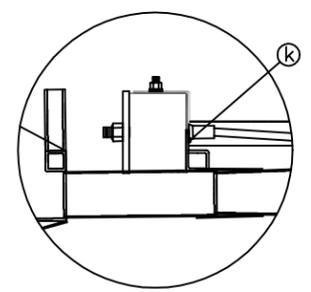
TRAFFIC → PLAN



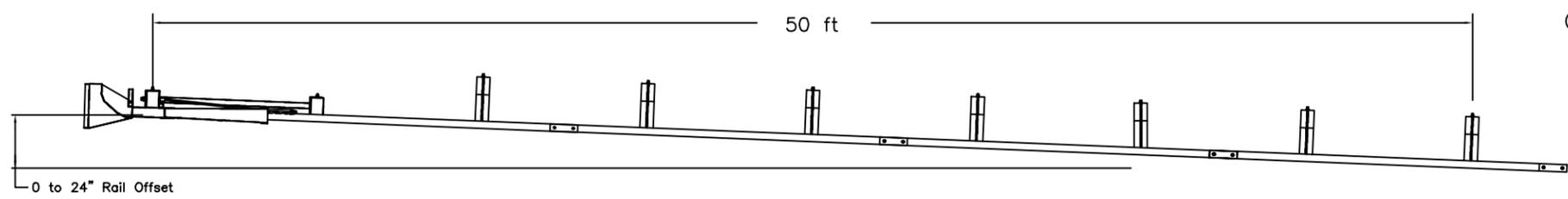
ELEVATION



POST #1 CONNECTION DETAIL



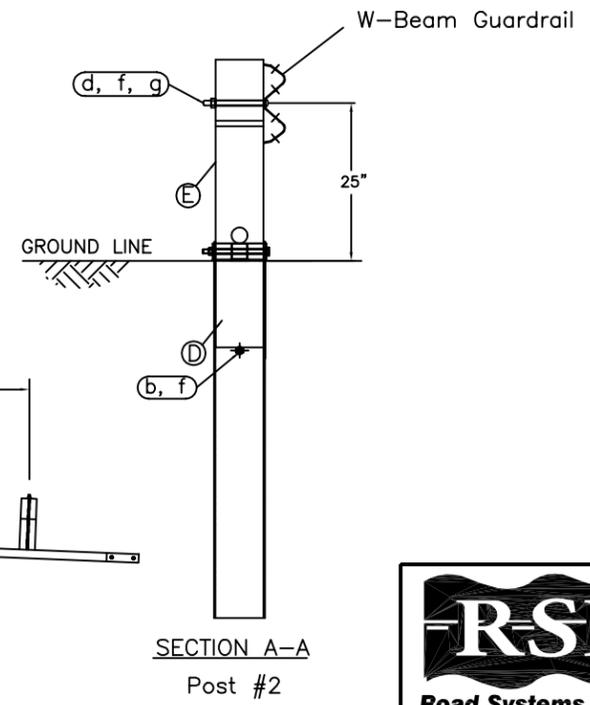
IMPACT HEAD CONNECTION DETAIL



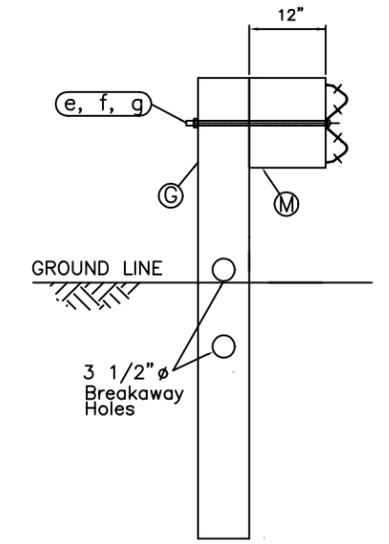
OPTIONAL FLARED INSTALLATION
25:1 maximum flare rate

- GENERAL NOTES:
1. Breakaway posts are required with the SKT.
 2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
 3. The SKT can be flared at a rate of up to 25:1 to prevent the impact head from encroaching on the shoulder.
 4. The foundation tubes shall not protrude more than 4" above the ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
 5. When rock is encountered, a 12" Ø post hole, 20" into the rock surface may be used if approved by the engineer. Granular material will be placed in the bottom of the hole, approximately 2.5" deep to provide drainage. The first two posts can be field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
 6. The breakaway cable assembly must be taut. A locking device (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening nuts.
 7. A site evaluation should be considered if there is less than 25' between the outlet side of the terminal and any adjacent driving lane.
 8. The soil tubes may be driven with an approved driving head. They shall not be driven with the post in the tube.
 9. The wood blockouts should be "toe-nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks.

ITEM	QTY	BILL OF MATERIALS	ITEM NO.
A	1	IMPACT HEAD	S3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga.	S1303 MGS
C	3	W-BEAM GUARDRAIL, 12 Ga.	G1203 MGS
D	2	FOUNDATION TUBE	E731
E	2	BCT WOOD POST	P650 MGS
F	1	GROUND STRUT	E780
G	6	CRT WOOD POST	P671 MGS
H	1	BEARING PLATE	E750
J	1	PIPE SLEEVE	E740
K	1	CABLE ANCHOR BOX	S760
L	1	BCT CABLE ANCHOR ASSEMBLY	E770
M	6	MGS TIMBER BLOCKOUT OR EQUIV.	P618
HARDWARE (ALL DIMENSIONS IN INCHES)			
a	24	5/8Ø x 1 1/4 SPLICE BOLT	B580122
b	2	5/8Ø x 7 1/2 HEX BOLT	B580754
c	2	5/8Ø x 10 HEX BOLT	B581004
d	1	5/8Ø x 10 H.G.R. BOLT	B581002
e	6	5/8Ø x 22 H.G.R. BOLT	B582202
f	35	5/8Ø H.G.R. NUT	N050
g	7	H.G.R. WASHER	W050
h	2	1 ANCHOR CABLE HEX NUT	N100
j	2	1 ANCHOR CABLE WASHER	W100
k	2	3/8 x 3 LAG SCREW	E350
m	8	CABLE ANCHOR BOX SHOULDER BOLT	SB58A
n	8	1/2 A325 STRUCTURAL NUT	N055A
o	16	1 1/16 OD x 9/16 ID A325 STR. WASHER	W050A



SECTION A-A
Post #2



SECTION B-B
Posts 3 thru 8

RSI
Road Systems, Inc.
Big Spring, TX
Phone: 432-263-2435
or Phone: 330-346-0721

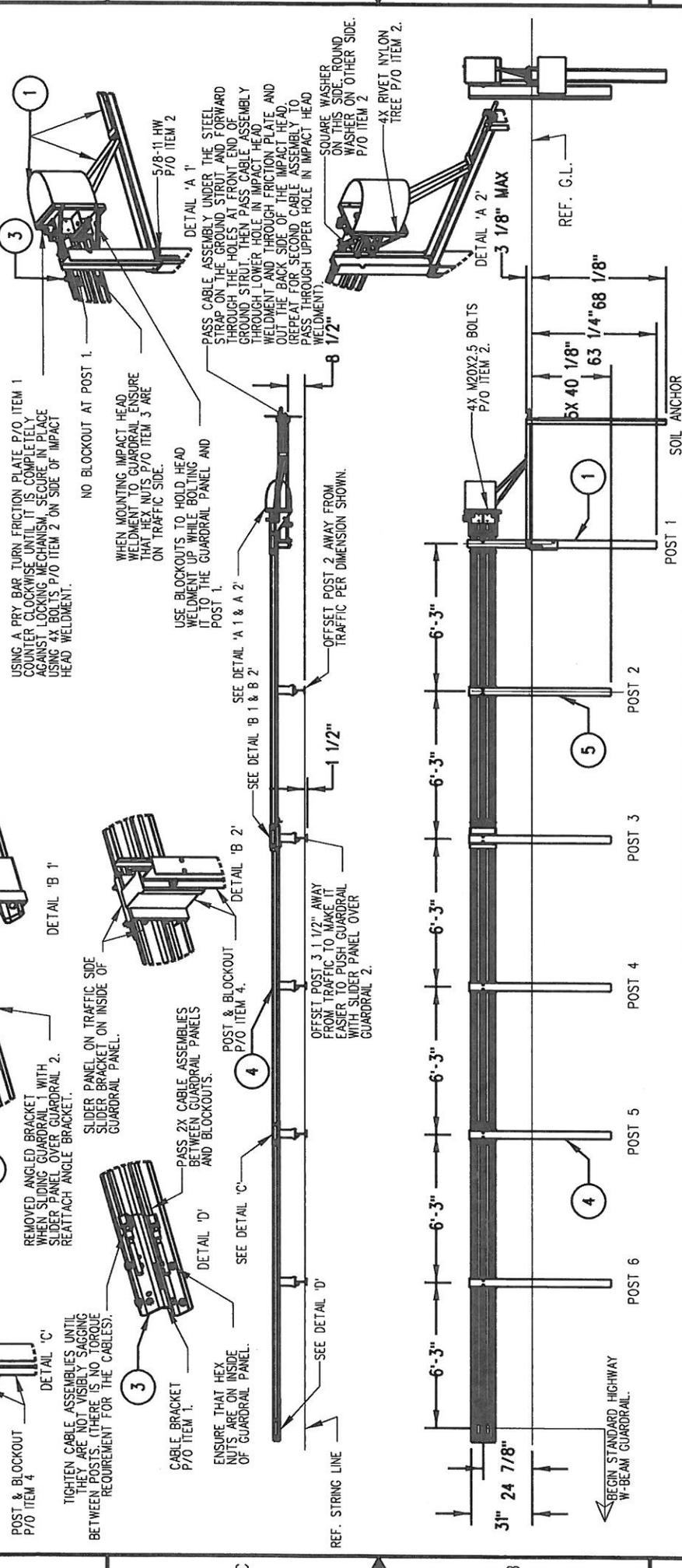
Sequential Kinking Terminal
SKT - Assembly

Midwest Guardrail System
Wood Post System

Drawing Name: SKT-MGS-W-US Scale: NONE

Sheet: A1
Date: 12/01/04
By: JRR
Rev: 0

ITEM NO.	PART NUMBER	DESCRIPTION	QTY	UOM
1	BSI-1307252-K1	X-Tension Terminal Comp, 31 in	1	EACH
2	K070202	X-Tension Hardware Kit, GT	1	EACH
3	K070206	X-Tension System Hardware Kit, EACH	1	EACH
4	K070210	X-Tension GT Guardrail	1	EACH
5	B061100	BSI I-Beam Post, Middle, X350	1	EACH
6	MANXT1	X-TENSION Installation Manual	1	EACH



LINDSAY
 TRANSPORTATIONAL SOLUTIONS
 BARBER SYSTEMS INC.
 3333 Voca Valley Parkway, Ste 800
 Voca, TX 75793-5959
 Tel: 817-600-5959
 Fax: 817-600-5960
 www.lindsay-systems.com

TITLE: X-TENSION GUARDRAIL TERMINAL SYSTEM STEEL POST WITH COMPOSITE BLOCKOUT 31" RAIL HEIGHT

REV. B

SIZE: B
 DWG. NO.: 2708/13

SCALE: 1:50

DATE: 2/08/13

ECN*:
 REV: 2/08/13

DO NOT SCALE DRAWING

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DECIMAL ANGLES ARE 1/2°.

TOLERANCES PER ASME Y14.5-2009

APPROVALS: NMV
 DRAWN BY: JMT
 DRAWN DATE: 2/08/13
 APPROVED BY: JMT
 APPROVED DATE: 2/08/13

NOTES: UNLESS OTHERWISE SPECIFIED.
 1. SYSTEM TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS.
 2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE NUTS AT THE CABLE BRACKET (SEE DETAIL 'D'). DO NOT TIGHTEN THE CABLES AT THE FRONT OF THE GROUND ANCHOR.
 3. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING TO THE TOP OF THE POST.